Devoted to
TEXTILE
CHEMISTRY
BLEACHING
DYEING
PRINTING
FINISHING

APRIL 27, 1942
VOLUME 31, No. 9

AMERICAN DYESTUFF REPORTER

OFFICIAL PUBLICATION
of the
PROCEEDINGS
AMERICAN ASSOCIATION
OF TEXTILE CHEMISTS
AND COLORISTS

What's Happened to the "Seven Mules"?

Pearl Harbor made lots of changes in our lives—made lots of them in our industries, need it be said?

The "Seven Mules of Hosiery", those seven colors which made life so much simpler for the full-fashioned mills, did not find themselves out of work when milady sacrificed her supposedly irreplaceable silk stockings in the interest of parachute cloth.

No sir!

The same reasons which made the "Seven Mules" indispensable as a unit have made them necessities, individually, for many new functions brought about by Pearl Harbor. Yes sir—the "Seven Mules of Hosiery" are still doing a swell job!

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United States and Canada
for J. R. Geigy, S.A.
Basle, Switzerland

In Great Britain
The Geigy Colour Co., Ltd.
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DYESTUFF MAKERS GEIGY SINCE 1758 EST. 1764

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Summer uniforms . . .
Shirtings . . . socks . . .
Tents . . . parachutes . . .
Powder bags . . .
Textiles—for Victory!

There's a clear track ahead for greater speeds than the Textile Industry has ever before achieved!

There's a challenge to men and management to produce fabrics of a quality and in a variety and volume to make our Army and Navy the best clothed and equipped in the world . . . plus the necessary textiles for civilian use.

Mill engineers and superintendents are keeping a twenty-four hour a day watch over their equipment, seizing every opportunity to make repairs, improvements and replacements of obsolete machines.

They know that only in this way can they keep their plants at top-notch efficiency, avoid let-downs in speed or quality of production and be ready for the hard competition after the war.

Since 1820, the Butterworth Organization has served the Textile Industry in America... pioneering, building and improving machinery for the Wet End of Textile Finishing. Today, while Ordnance production has first call on our facilities, we are still building Textile Finishing Machines as required in America's great war program.

***64%**

of equipment now in use in the wet end of textile finishing cannot operate at a profit in competition with modern machines.

*Proved by Research

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In Canada: W. J. Westaway Co., Hamilton, Ont.

Butterworth

PRODUCING GUN MOUNTS FOR THE UNITED STATES ARMY

American Dyestuff Reporter, Vol. 31, No. 9, April 27, 1942. Published every other Monday. Copyright, 1942, by Howes Publishing Co., 440 4th Ave., New York, N. Y. Domestic subscription, $5.00; Canadian, $6.00; Foreign, $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the act of March 3, 1879.

MEMO
If you cannot obtain certain vats . . . have you tried to replace them with A.A.P. Napthols, Salts and Bases?
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for Rayons and Acetates is spelled:

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Textile plants today are turning out a wide variety of fabrics woven from these man-made fibers. Fabrics using these fibers alone, and in combination with wool, cotton and linen. And it is not surprising that the processing of many of these new blended fabrics should introduce new problems.

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And Olate is safe for every washable fiber and fabric.

Olate's fluid solutions penetrate fabrics rapidly and evenly . . . help assure even shrinkage and level dyeing. Its gentle action and free rinsing properties help safeguard rayon, acetate and union fabrics against streaks, dye blotches, creases and chafe marks.

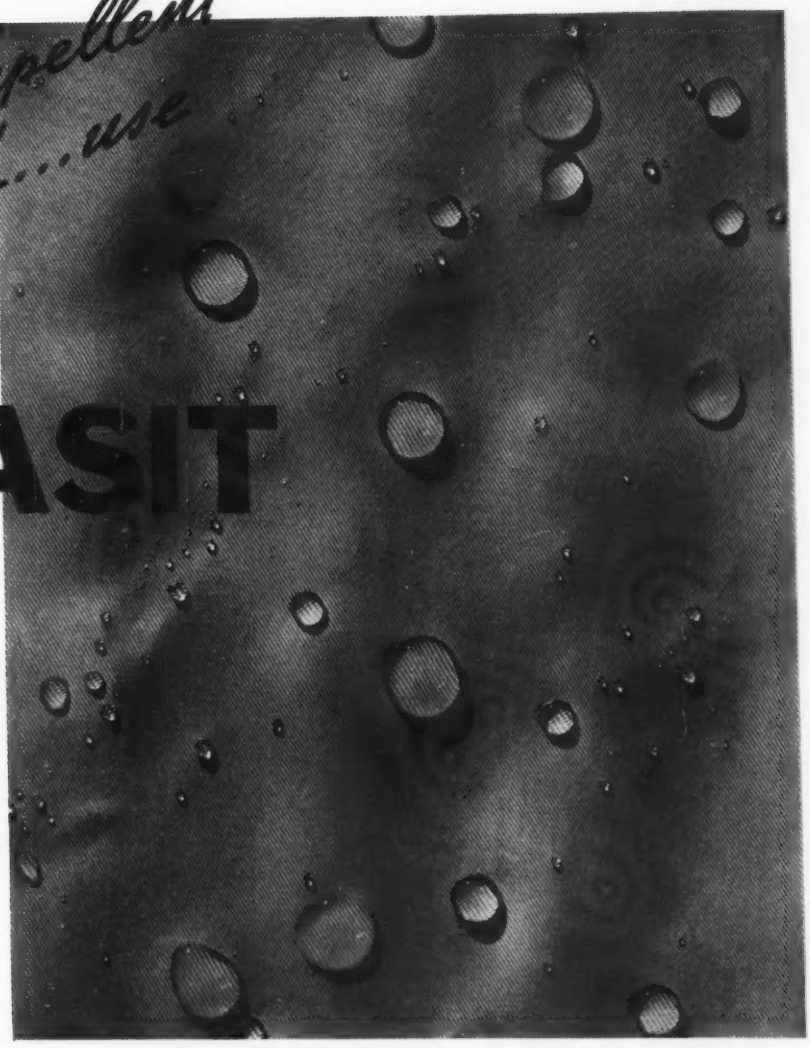
Olate can do a lot to give your fabrics the soft finish and pleasing handle that make them outstanding in eye-appeal and sales-appeal. In times like these when safe, efficient, economical production counts so heavily, it will pay you to weigh carefully the many time-tested advantages of Olate.

PROCTER & GAMBLE

Olate *the universal textile soap*

for a water repellent finish... use

RAMASIT



RAMASIT is a one-bath water repellent finish which, because of its low cost and ease of application, can be used on all grades of merchandise. It forms stable emulsions which are easily applied to cottons, rayons, silks and woolens on the quetch, padder, jig or beck. Ramasit imparts a superior water repellent finish. It leaves the fabric air porous and gives a soft and full handle. Information and samples will be sent at your request.

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April, 1942

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U. S. A.

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For "O D" Cotton F

With Sulphur Colors likely to play an important part in the production of "O D" Cotton Fabrics, Geigy presents a unit of three colors which research has developed specially to meet the prospective requirements of the armed forces.

***Eclipse Olive 6 G C F**

***Eclipse Olive 5 G C F Supra Conc**

***Eclipse Fast Brilliant Russet R C F Conc**

***These colors can be offered only for Defense Work.**

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These three colors simplify the dyehouse problem . . .

1. by their unusual solubility which makes them workable in all equipment—from open tubs to pressure dyeing machines.

2. by being confined within a short radius of the standard "O D's" they require no radical shading elements to cause uneven dyeing or wide variations from standard—yet they do present sufficient variety of shade and brightness within themselves to produce readily the standard "O D" shades no matter what the stock.

Geigy would be pleased to illustrate the attributes, simplicities and fastness of . . .

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***Eclipse Olive 5 G C F Supra Conc**

***Eclipse Fast Brilliant Russet R C F Conc**

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clear stitch

LESS PRESS-OFFS

Binds filaments

LUBRICATES YARNS

Thialene

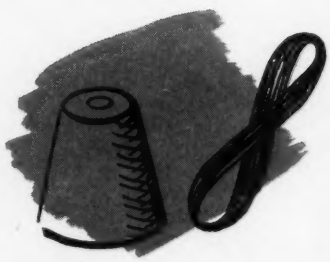
ENDS RAYON AND BEMBERG TREATMENT PROBLEM

SHEER HOSE

OILED OR UNOILED

skeins or cones

ROOM TEMPERATURE APPLICATION



SKEINS OR CONES

Don't worry about the present state of your yarn, and don't worry about a future shortage of coning production, for your yarn in either form can be Thialene treated.

OILED OR UNOILED

With the Thialene treatment, scouring is unnecessary for this new product will handle both oiled and unoiled yarns.

Within the last few weeks a number of loading mills have put into commercial use Thialene, Fancourt's new method for treating rayon and bemberg. Reports have been uniformly enthusiastic about this combination oil and size which binds the filaments and lubricates the yarn in one operation. Mills have found that it gives sheer hose with a clear stitch and consequently less press-offs.

It's easy to apply for it works at room temperature, and most important, your yarn doesn't have to be prepared to suit Thialene for the Thialene method may be used whether the yarn is in skeins or on cones, whether it is oiled or unoiled. Others have proved the value of this new product. A letter, wire or phone call can bring these same advantages to your mill.

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Greensboro, North Carolina

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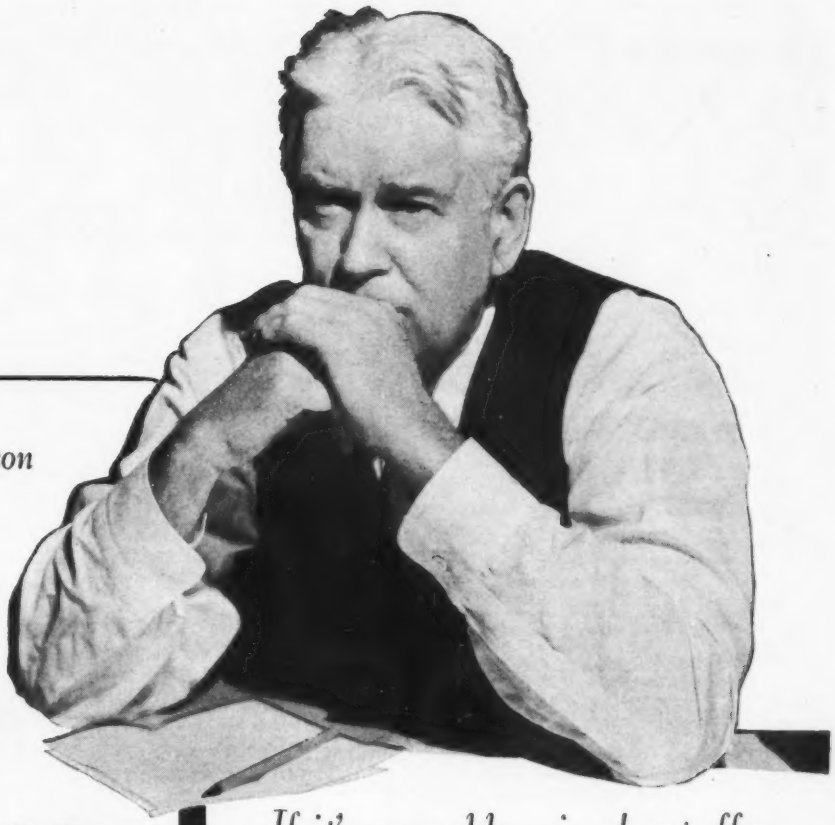

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The ever increasing requirements of our Government must be met . . . When it comes to dyestuffs, we can assist you to meet the specifications for:

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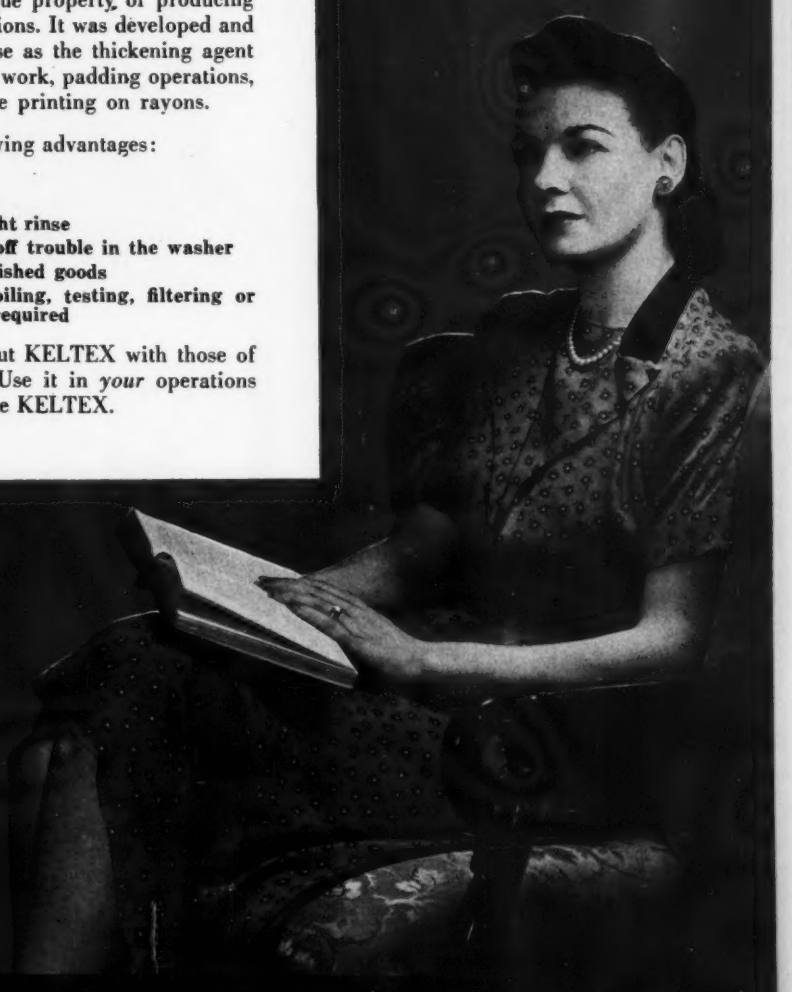
KELTEX has the unique property of producing highly viscous solutions. It was developed and is especially made for use as the thickening agent in print-pastes, discharge work, padding operations, gum-water, and direct-dye printing on rayons.

KELTEX gives the following advantages:

—good color yield
—excellent penetration
—easy removal with a light rinse
—no scratching or mark-off trouble in the washer
—low cost per unit of finished goods
—uniform quality—no boiling, testing, filtering or other special handling required

Compare these facts about KELTEX with those of your present thickener. Use it in *your* operations in *your* plant. You'll like KELTEX.



KELTEX
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  For solid shades on all cotton and rayon knit goods.
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  For wool and knit goods featuring fastness to light, milling and sea water.
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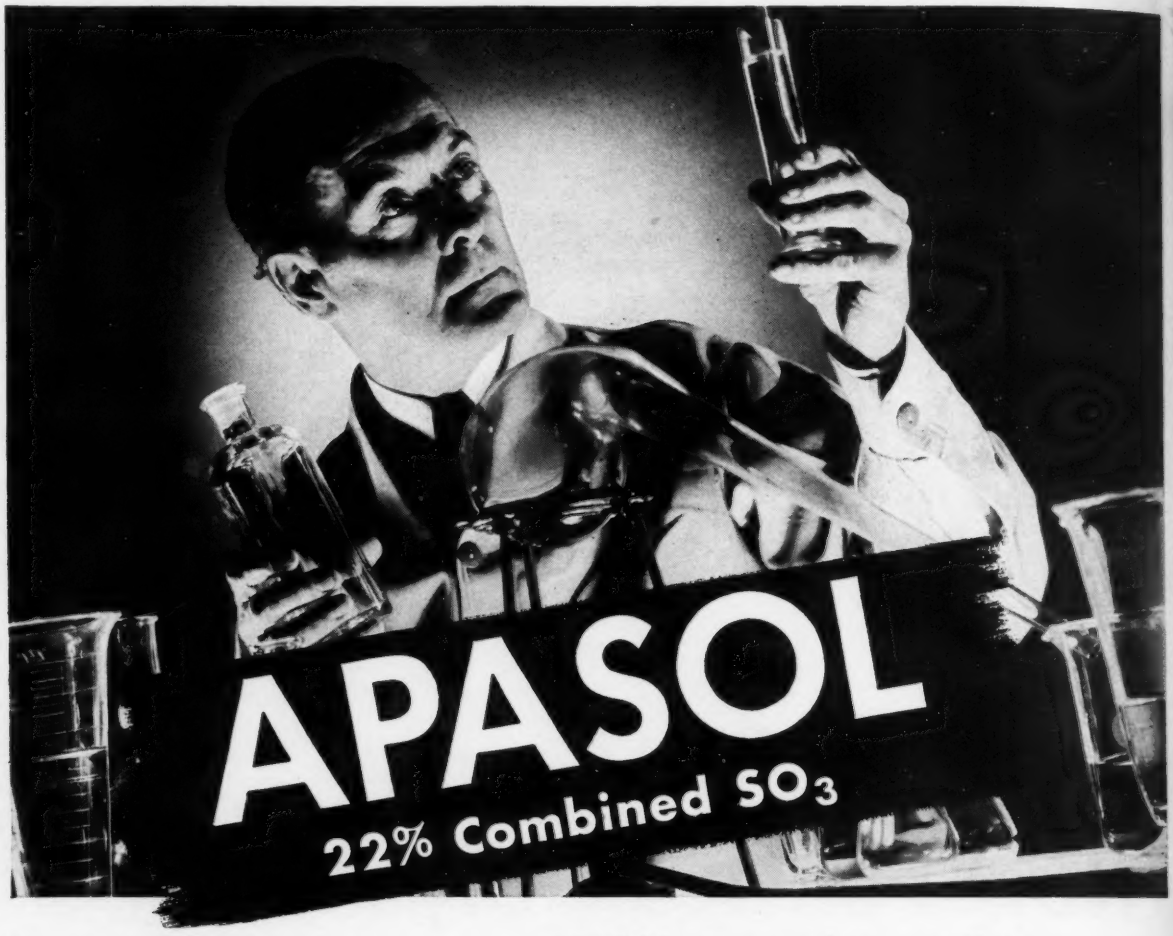
WATER REPELLENT

★Registration applied for U.S. Patent Office on both name and illustration.

A New All Purpose Sulphonated Oil



AFTER a long period of research and development, Jacques Wolf & Company offers APASOL, a highly efficient commercial oil for use in all wet processing of natural and artificial fibres.

Besides unusually high solubility, APASOL has a wide range of features to help your dyeing, bleaching, printing and finishing . . . APASOL assures complete penetration, has effective softening action. It is resistant to organic and inorganic acids and salt solutions (lime, Epsom and common salts).

APASOL brightens shades in dyeing—imparts a soft hand to cotton fabrics, makes artificial silks easier to wind and void of stickiness. In pasting colors, APASOL affords fine dispersion of naphthol and vat dyes.

APASOL gives you low cost efficiency in every wetting process:

Desizing—APASOL is a preliminary wetting agent.

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Bleaching—APASOL acts as a stabilizer and softening agent.

Dyeing—APASOL assures thorough wetting out and absolute penetration.

Soaping after dyeing—APASOL is an efficient dispersing agent, prevents formation of lime soaps.

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to Rayon's 5 Questions

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D Y E I N G

F I N I S H I N G

1. With Laurel Rayon Coning Oil and Laureltex #40, you gain resiliency—so important in the present wider applications of rayon.

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3. Other advantages include more even running, fewer ends down, clearer stitch, great reduction in sinker lines, more effective lubrication, greater output per worker with less strain or fatigue, non-oxidizing and complete removal in regular scouring operation.

4. Laureltex #40 is used in combination with gelatin for soaking rayon to produce crepe.

5. Your problem may require special formulae—we shall be glad to make suggestions.

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- Laurel Coning Oils
- Laurel Rayon Size
- Laureltex #40
- Ruxite N. F.
- Laurel Rayon Finishes
- Laurel Supersulfates
- Laurel Textile Oils
- Supersol A
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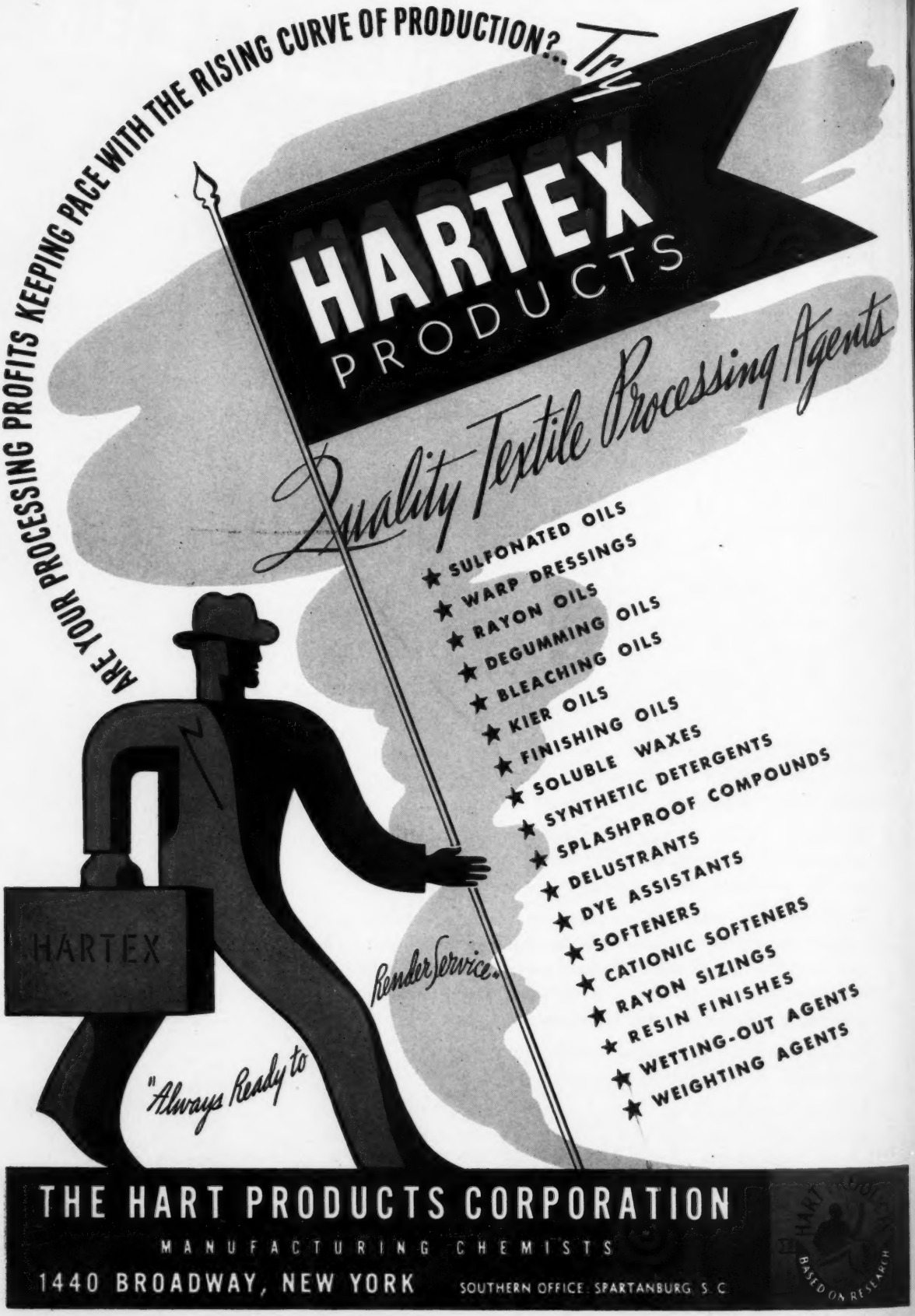
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No. 5 in a series of advertisements about new research chemicals.

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Our laboratories are constantly at work, synthesizing new chemicals, discovering new and broader uses for those chemicals that have already proved their usefulness, and developing more efficient and less expensive ways of making them. These newcomers have resulted from this research program.

Although only research quantities are available now, it is possible that commercial quantities will be made in the future if important uses develop. Write for price quotations.

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Unit of Union Carbide and Carbon Corporation

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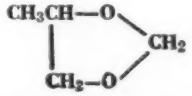
Butyl "Cellosolve" Acetate

$C_4H_9OCH_2CH_2OOCCH_3$

. . . is a colorless, stable liquid with a pleasant ester-like odor. Because it possesses high solvent powers for nitrocellulose, cellulose esters, and synthetic resins, it may be used in special surface coatings, printing inks, and varnish removers. It is less water-soluble and evaporates more slowly than "Cellosolve" Acetate. Specific gravity at 20/20° C., 0.940; boiling point, 191.5°C.; refractive index, 1.4160; solubility in water at 20°C., 1.1 per cent.

4-Methyl Dioxolane



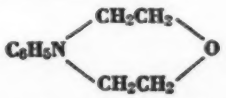
. . . is a colorless liquid useful as an extractant and solvent for oils, fats, waxes, dyestuffs, and cellulose derivatives, especially cellulose acetate. It boils at 85°C., and is 20 per cent soluble in water at 20°C. Its specific gravity is 0.988 at 20/20°C.

Methyldiethanolamine

$CH_3N(C_2H_4OH)_2$

. . . is an amine-odored, colorless liquid, miscible with water and benzene. It is suggested as an intermediate in the manufacture of textile auxiliaries, insecticides, emulsifying agents, and corrosion inhibitors. It shows some evidence of selective action in the absorption of acidic gases. Its physical properties include: specific gravity, 1.043 at 20/20°C.; refractive index, 1.4699; boiling point (at 4 mm.), 121°C.; equivalent weight, 119.

N-Phenyl Morpholine



. . . is a white solid suggested as a chemical intermediate in the manufacture of dyestuffs, rubber accelerators, corrosion inhibitors, and photographic developers. It is one per cent soluble in water at 20°C., melts at 52-56°C., and boils at 265-268°C. Its vapor pressure is less than 0.1 mm. at 20°C.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

Wide Range of use is Big Feature of

THE present price of Indigosol Golden Yellow IGK makes possible the use of this very fast Indigosol for economical dyeing and printing operations.

In combination with Indigosol Green IBA, very fast green shades are now available to the printer and dyer for the first time at a very reasonable cost.

An excellent printing color on cotton and rayon, it is also of great interest to the dyer of cotton, rayon and wool.

In case of application, the perfectly level shades obtained, and the unusually excellent penetration of heavy goods makes the entire line of INDIGOSOLS especially valuable to the fast color dyer or printer.

Indigosol Golden Yellow IGK

Brightness and Economy are Characteristics of

PHARMASOL Golden Yellow N produces clear, bright, fast and economical golden yellow shades when printed on cottons or rayons.

When mixed with Pharmasol Scarlet GNN, or Pharmasol Red GNN, a complete range of Tangerine and Gold Shades can be obtained.

Low cost Browns are obtained by mixing with either Pharmasol Blue GNXX or with Pharmasol Blue GDNN.

PHARMASOLS are solutions of stabilized azoic dyes and adjusted to the most practical concentration which can be easily applied with a maximum of efficiency.

PHARMASOLS solve the problem of troublesome dissolving and the uncertainties thereof—and as there is no decomposition there can be no loss of material or value.

Pharmasol Golden Yellow N

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APRIL 27, 1942

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Finishing the Newer Types of RAYON HOSIERY

DR. HUGH H. MOSHER

Onyx Oil and Chemical Company

THE newer types of quality hosiery are being constructed from rayon yarns and, to the surprise of many, are giving satisfactory performance in use. Yet rayon has never been considered an adequate medium for the fabrication of a serviceable hose. The strength and elongation have been considered too deficient, particularly when wet, to withstand the tension and friction imposed on it during ordinary use.

Past experiences have rather confirmed this popular impression of the inadequacies of synthetic fibers for use in the boots of hosiery. The merchandise was unable to withstand the strain of use and became "baggy" and unsightly after short service. However, it must be stated that stylists made but little attempt to design constructions which would minimize the inherent weaknesses of rayon fibers. Rather, the yarn was substituted for silk in merchandise developed to accentuate the charm and lure of the silkworm's product. Such construction accentuated the defects of the synthetic fibers, and rayon became discredited as a hosiery fiber.

Necessity breeds ingenuity and when Governmental priorities removed not only silk but nylon as well from the available textile lists, it became encumbent upon the ingenuity of the textile industry and its associated designers and scientists to evolve a quality stocking from the only fiber available for the creation of luxurious textiles. That fiber is rayon.

The success that these newer hose will achieve will depend, to a large measure, upon the success with which textile stylists and technicians can obviate the inherent weaknesses of rayon yarns.

The rayon fibers that are produced at the present time possess two characteristics defects, namely, lack of strength, particularly when wet or damp, and low elasticity. The former defect tends to give poor serviceability and the latter to produce a baggy hose after very limited wear.

Both weaknesses can be improved by the use of twisted yarns. It is well known that the strength of any fiber can be increased by twisting its yarns until a certain number of turns are secured, after which the filaments tend to split and weaknesses are generated. As the strength of the fiber is increased by twisting, elasticity defects are simultaneously minimized. The improvement in the elasticity of a yarn by twisting is more apparent than real, although the effects in a fabric are those of a real benefit.

The physical improvements in the strength and elasticity of rayon yarns by twisting follow the usual laws of textiles. The optimal result is secured at about thirty turns per inch, above which point further twisting results in a gradual deterioration in the tenacity of the yarns. The employment of these twisted yarns in hosiery constructions has enabled knitters to circumvent many of those adverse properties present in the older types of rayon hosiery.

The twist requirements of rayon yarns for hosiery constructions, however, have not yet been established. The twisting and creping of yarns result in the formation of a spiral thread and if the serrations are too sharp, they tend to act as miniature saws. As a result, the use of a too tightly twisted crepe in hose yields a product of poor serviceability. The yarns tend to cut each other in the stitches and the seam, and disappointing wear is inevitable.

The knitter must balance the improvement in strength and elasticity of his rayon by twisting against the abrasive properties produced and regulate the number of turns in order to avoid excessive abrasion. Most rayon hosiery today is made from yarns containing between twelve and twenty-five turns per inch. (Ray de Chine may be higher.)

The scouring and dyeing of quality rayon hosiery does not ordinarily present any particular difficulty when conducted in accordance with well recognized hosiery practices and exerts even less influence on the life and durability of the textile than on silk materials. On the whole, the principles of rayon hosiery dyeing are similar to those employed in processing silk. Rayon, however, being free from sericin and containing no artificial prototype, can be scoured with much greater readiness.

The finishing of the dyed product is a much more important operation. While silk and nylon yarns possess no

conspicuous weaknesses and can give acceptable service even without finishing when knitted into a hose of conventional design, the rayon yarns possess certain inherent defects, namely, low tenacity and elongation. Although these defects can be partially masked by suitably twisted yarns, the use of corrective sizes is usually demanded to strengthen the fibers and prevent the serrated peripheries from exerting an abrasive action on the stitches and seams of knitted fabrics.

With the exception of these corrective finishes the demands for rayon finishing sizes are similar to those for silk and nylon hosiery, although the chemicals employed to accomplish the objective may be very different.

The functions of the finishes may be grouped into the following classifications:

1. To correct inherent rayon defects.
2. To mask yarn and knitting imperfections.
3. To accentuate or restrict some natural rayon property, such as luster or softness.
4. To increase the serviceability of hosiery by increasing its resistance to bagging, fraying, abrasion, etc.
5. To simulate in an inferior hose the hand and appearance of a product of superior quality.

The trade requirements for hosiery vary, and it is not to be assumed that all of the objectives enumerated are demanded for all types of rayon stockings. Indeed, the type of finish required depends upon the construction of the fabric, fashion, and the purpose for which the material was designed.

CORRECTIVE FINISHES

As was forestated, the deficiencies in tenacity and elongation of rayon yarn may be partially corrected by twist, but such yarn, because of its serrated periphery, may produce holes in the stitches and seams of hosiery prepared from it.

Two types of finishes have been found useful in restricting the adverse properties of such yarns. The first is designed to sheathe the fibers of a hose in a film possessed with sufficient strength to absorb much of the initial shock of tensions imposed on stockings during use and thus prevent its fibers from stretching beyond their elastic limits and producing a baggy stocking. The second type of finish is a lubricant which should sheathe the bare fibers or the sized yarns in a tough oily film. Such an oil cushion enveloping the fibers tends to prevent the hose yarns from impinging directly against each other during use, but rather causes them to slide across the oil films precisely as if ball bearings separated the yarns at their points of contact.

The number of suitable reinforcing sizes are not numerous. Many natural waxes, glues, gums, and starches are capable of supplying the requisite film structures. Unfortunately, only a few yield the film strength necessary for real service in promoting greater wear. Of the natural sizing agents the hosiery finishes has extensively applied but two types, modified gelatins and starches. Unfortunately these furnish but a transient effect and as they are completely eliminated from the fabric after one or two washings, they possess very little real value in increasing the durability of rayon hosiery. Their chief virtues lie in supplying weight and body to the rayon, in leveling curled edges, and in imparting to the hose a "finish" effect.

Various synthetic resins have been of particular usefulness in imparting a durable reinforcing action. Among this class of resins we should include particularly the alkyd, urea-formaldehyde, urea-acetone, and various types of cellulose ethers and esters. Several of these may be classified as poly-functional finishes because in addition to reinforcing the yarns, they also supply the hose with body and weight. In a few instances, such as the alkyd resins, they exert a dulling action on the fabric. Unfortunately, it is difficult to secure these types of resins at the present time, and some of the more valuable synthetic sizes are not available for textile use.

Although many types of mineral and vegetable oils, either dispersed or combined with sulfuric acid as sulfated oil, are employed as fiber lubricants to cushion the yarns of a hose against abrasion, the choice of lubricant should be carefully made. It is essential that the oil possess resistance against atmospheric agencies and oxidation. Properly balanced emulsions of dispersed oils, raw and partially sulfated alcohols, and the cationic softening agents have proved the most efficient lubricants because of their greater resistance against conversions during ageing and greater resistance to removal during laundering. Certain of the cationic auxiliary actually affix themselves to cellulosic fibers, and when properly affixed they impart a permanent effect. It is on these products that the industry depends for its permanent lubricants and softening agents.

FINISHES USEFUL IN MASKING YARN AND KNITTING IMPERFECTIONS

Science has not yet been able to achieve perfection in either yarn formation or in knitting. Consequently, all knit goods possess certain imperfections which vitiate the appearance of the knitter's creations. These defects exhibit themselves in hose as irregular stitches, sleaziness, and broken filaments.

These visual defects may be masked by employing finishing agents possessed with astringent properties and a dulling action to subdue the luster of bright fibers. Although many chemicals could be utilized to produce the desired effects, the joint action of suitable waterproofing and dulling agents have been almost exclusively utilized for the purpose.

The astringent properties of waterproofing agents contract the fibers of rayon hosiery and through this action tend to tighten and straighten the malformed stitches and wales, cover sleaze, and simultaneously cover the yarns of a hose with a filmy integument.

The covering characteristic is enhanced by pigment dullers. These products, which are usually stable dispersions of some type of barytes, titanium dioxide, zinc oxide or some type of clay, fill in the minute crevices in the yarn

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KNITTED GARMENTS

Used by the United States Navy

ROY G. BUCK, Lt. S. C., U. S. N.

AT the present time, the United States Navy is procuring ten knitted garments as a part of the uniform of the enlisted personnel. The quantity of each article purchased within a year reaches sizeable proportions, in some cases running into seven digit figures. In order to obtain uniformity in material, workmanship, and appearance each garment must be made in accordance with the governing specifications. These specifications have been adopted by the Navy Department only after exhaustive tests have been made on the garments and have proven that they would yield satisfactory service. The specification title and number of each garment currently being procured are listed below.

NAVY DEPARTMENT SPECIFICATIONS

73C3a—Caps, Watch.
73G2a—Gloves, Woolen.
55J2h—Jerseys.
37T2a—Trunks, Bathing.

Federal Specifications

JJ-S-566a—Socks, Cotton.
JJ-S-581a—Socks, Wool and Wool-Cotton Mixture.
JJ-U-513—Undershirts, Men's (Cotton, Flat-Knit, Light-Weight).
JJ-U-517—Undershirts, Men's, Cotton-Wool Mixed.
JJ-D-653—Drawers, Men's, Cotton-Wool Mixed.

CAPS, WATCH, require a 2- or 3-ply worsted yarn made from fleece or pulled wool of a grade not lower than 50s (U. S. Standard). The color is dark blue (stock or yarn dyed), including thread used for sewing, and must have good fastness to light, laundering, perspiration, and crocking. The caps may be knitted on either a flat or circular machine, using a full cardigan stitch, with 6 to 7 wales (ribs) to the inch and 12 to 13 courses (stitches) to the inch. When the fabric is made on a flat machine it must be knitted the required width, not cut, and the edges are then joined with a 2-ply worsted yarn using stitch type 502 or 503. When the fabric is made on a circular machine and cut, the edges are joined by first seaming with stitch type 504 using threads of 2-ply worsted yarn and one thread of number 50/3 cord cotton, and then cover seamed with stitch type 406 using one thread of 2-ply worsted yarn and two threads of number 50/3 cord cotton. The bottom of the cap has a rack stitch with a straight (or similar stitch) for about ⅝ inch in width. The top of the crown is formed by cutting and joining six darts approximately 1½ inches deep. The darts are joined with three cross seams, first seaming with stitch type 504 using two threads of 2-ply worsted yarn and one thread number 50/3 cord cotton, and then cover seamed with stitch type 406 with one thread of 2-ply worsted yarn and two threads of number 50/3 cord cotton. The thread used in seaming must be of the same color and color fastness as the cap. All sewing operations are conducted with not less than ten stitches per inch. The caps are a full 11 inches in length and 8¼ to 8¾ inches in width at the bottom, when finished. Each cap must weigh not less than 3¼ nor more than 3¾ ounces.

GLOVES, WOOLEN, require a 3-ply woolen yarn made from fleece or pulled wool of a grade not lower than 56s (U. S. Standard). The color is dark blue (stock dyed), and must have good fastness to light, laundering, and crocking. The gloves are what is known as thoroughly full fashioned, seamless, machine knit. The cuff is a rib knit, 1 x 1, or 2 x 2, with 64, 68, 70, or 72 needles. The cuffs are seamless, approximately 3 inches long, with a welt at the upper edge to prevent raveling. The hand is made using 64, 68, 70, or 72 needles, approximately 6 needles to the inch. The thumb is inserted in such a way that the edges of the thumb are from 4 to 6 needles from the back of the hand, so as to leave plenty of room in the palm of the hand to prevent undue strain. A gore is formed for admission of the ball of the thumb with openings of 28, 30, and 32 needles, respectively, according to size, and then narrowed in the usual way to 24, 26, and 28 needles, respectively, according to size. The thumb is knitted to the proper length and then narrowed to 8 to 12 needles, according to size, and the tip finished by hand work. The fingers are knitted seamless, of proper graduated lengths overlapping each other to give a good fit to the hand. This overlapping must be done in the knitting and not acquired by laying off forms. The tips of fingers are narrowed to 12 to 14 needles, according to size, and the tip is finished by hand work. The gloves are made in three sizes:

Size	*Measurement*	*Weight/Dozen Pairs*
Small	10 inches	29 ounces
Medium	10½ inches	30½ ounces
Large	11 inches	32 ounces

Measurements are taken from the tip of the middle finger to the top of the cuff. A ¼-inch tolerance, plus or minus, is permitted. Each side should have its proportionate width.

JERSEYS require a 2-ply worsted yarn made from fleece wool of a grade not lower than 56s (U. S. Standard) combing wool. The color is dark blue (skein dyed), including thread used for sewing, and must have good

fastness to light, laundering, perspiration, and crocking. The jerseys are knitted in a circular machine, using a plain stitch, with 10 to 11 courses (stitches) to the inch. with a minimum number of needles per machine, as outlined in the table below. The body is circular without side seams. The sleeves are tubular and seamless between the shoulder and the elbow, and are shaped between the elbow and the wrist by seaming, with the seam fully covered. The cuff is a 1 x 1 rib, 2½ to 2¾ inches long, without seams and of double thickness. The collarette is a 1 x 1 rib stitch, elliptical, 2 to 2½ inches wide, without seams and of double thickness. The border or waistband is a 2 x 2 rib stitch, 3½ inches wide, and made either by looped on or knitted continuously with the body. If the border is looped onto the body it is made with a rack over 2 needles, and if it is knitted continuously with the body it is made with a rack over one needle. The border is fairly stiff and elastic. All seams are made using a 2-ply worsted thread with seam type 401-SSa-1, and covered with stitch type 402 or 406. The sizes, dimensions, weight, and needles per machine for constructing the body and sleeves are tabulated in the following table:

must be not less than 50 pounds. The fabric should weigh 10.5 ounces per square yard, a tolerance of plus or minus 10 per cent. The threads used in sewing are cotton thread type IA3, 3-cord No. 40, black, and a 2-ply worsted yarn, having the same color and color fastness as the fabric. The waist is made with a hem about 2¼ inches deep sewed down with stitch type 402 or 406. A piece of ½ inch cotton tape, dyed fast (not sulfur) black, is inserted through the hem, with about 12 inches surplus on each end. Two well-made buttonholes are centered on the inside of the front about one inch apart for the draw string. Six belt loops, either tubular knit or made of the same fabric as the trunks of double thickness and sewed together, approximately ½ inch wide and 2½ inches long, are secured to the hem. The belt loops are evenly spaced, one on each side, two in front, and two in back. The tops of the belt loops are secured about ½ inch below the top edge and the bottom secured to the seam of the hem with well-made bartacks placed inside the loops. The hem at the bottom of each leg is about one inch deep and sewed down with stitch type 402 or 406. The crotch has a square insert of double thickness, about 3½ inches long on each side when finished. The seaming is done with seam type 502-SSa-1 or 503-SSa-1, and covered with stitch type 402 or 406. Cotton sewing thread is used in all sewing operations requiring seam type 502-SSa-1 or 503-SSa-1, buttonholes and bartacks. A worsted thread is used in all other sewing operations. The sizes and measurements are tabulated in the following table:

	Size							*Tolerance*
	32	34	36	38	40	42	44	(±)
Chest ..... inches	29	31	33	35	37	39	41	1 inch
Length (from shoulder seam) ..... inches	24	25	25	25½	26	27	27½	1 inch
Sleeve length (from shoulder seam) ..... inches	20	20½	21	21	21½	22	23	½ inch
Weight (per dozen) ..... pounds	8	9	9½	10	10½	11½	12½	5 per cent
Needles per machine for body, minimum	196	210	224	238	252	264	280	
Needles per machine for sleeves, minimum	90	90	90	96	96	96	108	

An alternate specification varying from the above requirements is being used at the present time. The requirements of this alternate are summed up as follows: The yarn is a 2-ply worsted made from a fleece wool of a grade not less than 52s commercial standard combing wool. The body side seams or mock side seams on both sides extend from under the armhole to the bottom of the border or waistband. The sleeves are cut and sewn, shaped between the shoulder and wrist by seaming. The cuffs are 2½ to 2¾ inches long, and may be either knitted or sewed on double thickness, using a 1 x 1 rib stitch. The collarette may be made with the use of concealed seams. The border or waistband is a 2 x 2 rib stitch, 3½ inches wide, either sewn on, looped on, or knitted continuously to the body. All seams are made with a 2-ply worsted yarn, or with a combination of 2-ply worsted yarn and a 3-ply cotton sewing thread, with seam type 401-SSa-1, and covered with a 2-ply worsted yarn using stitch type 402 or 406.

TRUNKS, BATHING, require a 2-ply worsted yarn made from fleece wool of a grade not lower than 60s (U. S. Standard) combing wool. The color is dark blue (stock or yarn dyed), and must have good fastness to light, laundering, and perspiration. The fabric from which the trunks are made may be knitted on either a flat or circular machine, using a 1 x 1 rib stitch, with not less than 22 wales (ribs) per inch and not less than 35 courses (stitches) per inch. The breaking strength along the wales

Size	30	34	38	42
	Inches	*Inches*	*Inches*	*Inches*
Waist	21	22	27	30
Entire length of leg at side	11	11	12	13
Front, from top of waistband to center of crotch	13	14	15	15
Width of leg at bottom	7	8	8	9

A tolerance of ½ inch (plus or minus) in the measurements for waist, length, and front, and of ¼ inch (plus or minus) for width of leg will be allowed. An alternate specification requirement in that a single worsted yarn may be substituted for the 2-ply worsted yarn is being used at the present time.

SOCKS, COTTON, require mercerized yarns made from cotton not lower than "middling" grade, thoroughly carded and combed. The socks are seamless, circular knit. The leg, heel, and toe are made with a plain stitch. The heel and toe are knit from two ends of yarn, and the leg and foot are knit from one end of yarn. The ribbed cuff is a 1 x 1 rib, using one end of yarn, finished with a pronounced welt and joined to the leg, loop for loop,

(Continued on page 220)

Developments in
RAYON HOSIERY DYEING

HAROLD L. DeTURCK

THE war has brought about a drastic change in the hosiery industry affecting it to an extent that was inconceivable even a few months ago. After being deprived of its main staple yarns, silk and nylon, it had to quickly adjust itself to the manufacture of rayon and cotton stockings. The industry is to be complimented on the rapidity with which these changes were made. Rayon hosiery is now offered to the consumer which, in addition to being extremely attractive, is also serviceable.

This achievement is especially praiseworthy when you consider the complications which arose out of the use of hitherto unknown yarns, wherein each type of rayon, in addition to each individual producer's thread, shows different characteristics in manufacturing, dyeing and finishing, which is in direct contrast to silk, nylon and cotton.

The three types of rayon in common use are viscose, cuprammonium and acetate. However, the hosiery manufacturer is practically confined to the use of viscose and cuprammonium yarns. The change from silk and nylon chiffon styles necessitated the use of fine denier rayons for which only 75 denier and probably 65 denier yarns could be considered. Even these had to be given a relatively high twist in order to reduce the diameter to simulate the appearance of its predecessors and to further provide the necessary elasticity to make the stockings comfortable.

Such high twisted yarns have, however, presented unknown difficulties to the knitter and special sizings and processes had to be developed to make the thread pliable in order to achieve normal production figures on the knitting machine.

The treatment of these yarns preparatory to knitting and the reaction of the different types in dyeing and finishing have confronted the hosiery dyer with new problems. Following are certain methods of procedure based on experiences gained so far, as well as explanations of some of the difficulties.

It is good practice to begin with laboratory tests of the yarn and the finished gray stockings, investigate which type of oil, size, tint and other impurities they contain and then work out a method of easy removal. It is comparatively simple to distinguish a vegetable, animal and mineral oil using an ultra violet light apparatus. After obtaining this information a decision is made regarding the dyeing method.

Two dyeing methods, namely, a single or double boil off bath may be employed. The former dyes and scours in the same liquor while the latter removes a portion of the oil etc., in the first operation after which the dyeing is completed in a clean second bath. Rayon hosiery (viscose and/or cuprammonium) as received in the dye house contains a size consisting mostly of saponifiable or mineral oils, soaps, fatty alcohol sulfate, sulfonated oils, throwsters tints and in addition a certain amount of impurities. The presence of the latter in the liquor prevents uniform dyeing unless removed before or during the dyeing operation. If the nature of the ingredients on the thread is known and the goods are clean the single bath method may be used. However, if there is any doubt regarding the type and condition of the yarn, the double boil off method is preferable.

Regardless of the procedure used it is best to select good dyeing assistants and scouring agents. The bath should contain a potent wetting and dye dispersing agent to obtain level dyeing action and an emulsifying agent to dispose and remove oils, etc., from the fibers. The viscose and cuprammonium types of rayon are fairly resistant to alkalis so that some of the impurities can be removed by having a small amount of a mild alkali present in the bath. In dyeing either type it is best to bring the bath to a boil, introduce the dyeing assistants, add the dyestuff and boil for 30 minutes. Light shades do not require any Glauber's Salt but the medium and darker shades need ½ to 5 per cent. Upon this addition the bath is run for 15 minutes, sampled and the shade is matched. It is advisable to select the proper dyeing assistants or penetrants as they are needed to assist the dye to penetrate the seams and heels.

In selecting dyestuffs for either cuprammonium or viscose rayons, dyes should be obtained that level or migrate the same at various temperatures and it is best to use in combination only those colors which behave similarly in regard to exhaustion. The dyes are being produced by many manufacturers under a variety of names. The necessary dyes for viscose or cuprammonium are a direct brown, yellow, orange, red, gray with a serviceable shading, violet and blue. The proper selection of these colors allows the dyer to secure the correct color absorption to any pH range between 8.0 and 10.0 and a maximum color effect between temperatures of 180°-210° F. It is possible to obtain dyestuffs that possess the standard requirements regarding fastness to washing, light and perspiration. The war made it necessary for the dyestuff manufacturer to eliminate some of the direct dyes because some of the intermediates had to be used to manufacture dyes necessary for the defense program. In line with the dyestuff manufacturer, the hosiery industry decided to simplify its color line by offering the trade four colors only, with the result that fewer dyestuffs and smaller amounts are required to produce the adopted shades. Once the formula for a color is established, it can be used with slight modification for the styles designed with viscose or cuprammonium.

Viscose rayons are manufactured by approximately a dozen companies but there are very few of these that could be blended into one stocking without noticing a variation in shade between the various yarns. Sample swatches should be knit and then dyed in the laboratory. The result of this test enables the manufacturer to determine which types of yarn can be blended to produce a desirable stocking. Based upon the dyeing test, the stockings are knit with the blended yarns and again dyed either in the labora-

tory or on a small scale in the dye house before actual production is started.

The operation after scouring and dyeing is known as finishing. Finishing is done for the purpose of covering fabric defects and to impart to it properties not present in the fiber. Finishing has the following purposes:

1—Impart body as the trade demands.
2—Fixation of dyes.
3—Maintain the size and shape of the hose.
4—Strengthen the hose.
5—Cover sleaziness and fuzz.
6—Impart crushproofness.
7—Impart water repellency.
8—Impart dullness to the fiber.
9—Lubrication.

It is the aim of the hosiery finisher to give the bright and semi-dull rayon yarns a sheen similar to silk. The delusterant may consist of a suspension of titanium dioxide, china clay, bentonite, etc., in water in which has been added a suitable colloidal substance. The dulling may also be produced using the barium sulfate method. As a rule the bright rayon does not require a finish to impart body. In case this is desired it can be produced by using finishes that contain blended gums or using urea-formaldehyde condensate or the linear polymers, such as methyl methacrylate resins. Occasionally a dyer has trouble with a lot, resulting in the rayon becoming very harsh. It is possible using the cation softeners to eliminate this harshness. The cuprammonium rayon has a tendency to become wiry after prolonged boiling in the dye bath. Such goods cause difficulty in the boarding operation. Proper lubrication of the fabric is therefore essential, however, care must be exercised to select a finish which does not become sticky or has a tendency to leave a deposit on the forms when boarding the stockings. Many tears in the fabric due to excessive pull exerted by the boarder can be avoided if caution is observed at this stage in finishing. Specific formulae for the various types of rayon have to be worked out.

The correct amount of moisture contained in the stockings when reaching the boarding department is of paramount importance. The extraction of hosiery after finishing must be properly controlled. As is well known, rayon is substantially weaker in a wet condition and the energy required to pull such stockings on forms is likely to result in holes.

Thus far, this article speaks in terms of dyeing and finishing "all rayon" stockings. When combining various fibers, the difficulties are increased. All dyers are aware of the differences of affinity for direct dyes between bright, semi-dull, dull viscose or cuprammonium, mercerized and unmercerized cotton. A dull viscose thread that has titanium dioxide incorporated in the thread requires more dye and color than a bright viscose yarn. This evidently seems to be due to a change in light reflection caused by the white opaque substance. Unions of bright viscose yarns with mercerized cotton can be dyed with comparative ease but some of the low twist bright viscose threads with unmercerized cotton yarns do not blend well. Dyeing light and medium shades, in dull viscose and mercerized cotton, results in the cotton dyeing a fuller shade. It is known that cuprammonium rayon and viscose rayon will not produce the same shade when dyed in the same bath. Cuprammonium rayon in conjunction with certain mercerized cotton yarns will produce good union in light and medium shades but show a contrast in the dark shades because cuprammonium rayons more readily absorb the dyestuff. The latter should never be used with unmercerized cotton in hosiery. When dyeing cuprammonium-mercerized cotton unions it is advisable to omit the Glauber Salt in light shades and to use a minimum percentage in the medium shades. It has been our experience that the dull rayon tangle more readily and for that reason the single bath method is preferable. The dyeing procedure for all rayon stockings can be used for the rayon union dyeings. Where the rayon yarn dyes lighter than the cotton, as in viscose, it is possible to practice the cooling-back process whereby the rayon will absorb a portion of the dyestuff as the temperature drops thus obtaining a better union.

Sheer acetate rayon hosiery, due to the present low tensile strength of the finer denier yarns, has had only limited appearance in the trade. The dyes used are the dispersed insoluble type. With slight modification it is possible to use the same dyeing formulas adhered to in dyeing nylon. As in nylon, combination dyes which exhaust at an even rate should be chosen. The dispersed dyes are easily put into dispersed form by pasting the powder with Turkey Red Oil, sulfated fatty alcohol, etc. Live steam should not be employed to heat the solution as it is apt to upset the particle size. The goods are dyed with the assistance of soap and a sulfated fatty alcohol. The dyeing may be started at 120° F. and gradually raise to 180° F. in about 30 minutes. This is continued for another 30 minutes before sampling. For dyeing blacks the most economical dyes are those which are diazotized and developed. Preboarding has been found advisable in finishing acetate rayon hosiery in order to produce a better looking fabric. This procedure will prevent distortion known in the trade as "crow's feet" or crease marks.

A few thoughts regarding rayon-nylon hosiery. As in the all-nylon stocking it is necessary to preboard the rayon nylon fabric. Wetting the welts (viscose or cuprammonium) before preboarding, using a good penetrating agent or spraying the welts with an automatic mechanism set up in the preboarder or using shields, will help to minimize spotted welts found after preboarding such a style. To process rayon-nylon hosiery, it is necessary to adjust the present nylon scouring and dyeing procedure. It is important when selecting direct dyes for viscose or cuprammonium yarns to see that they have the following characteristics:

A—Stain the nylon as little as possible.

B—Should have same appearance in matching under artificial light as nylon.

C—Color is not affected in the finishing bath.

Proper selection of the direct colors is imperative because it will tend to minimize two-tone effects, rings and other imperfections.

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

APRIL 27, 1942

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CALENDAR of Coming Events

Meeting, Northern New England Section, May 15, 1942.

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., May 22, 1942.

Meeting, Southeastern Section, Atlanta, Ga., June 6, 1942.

Annual Outing, Philadelphia Section, Manufacturer's Country Club, June 12, 1942.

Annual Meeting and Convention, Atlantic City, N. J., October 9, 10 and 11, 1942. (Note change in date.)

THE MECHANISM OF DYEING*

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Director, Technical Laboratory
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THE mechanism of dyeing has been the subject of lively interest for half a century, but it is still far from being clear beyond any question of doubt. However, each year something is added to our experience, new facts are recorded or new measurements made confirming or refuting the opinions held till then. It is sometime since I last put together the composite to be obtained from available data and I am glad that you have given me this occasion of doing so.

The phenomena that must be given a logical explanation are described very simply but are in fact much more complex than would seem at first consideration.

Fibers, when immersed in a colored solution, take up the color by a process of absorption or sorbtion robbing the solution of color and becoming themselves very highly colored. The process is not simply one of imbibition, the concentration in or on the fiber becomes much greater than in the solution. The color, while it is in most cases not extremely firmly fixed is not easily removed as by mere rinsing.

The process is the transfer of a material contained in the liquid phase of a heterogeneous system to the solid phase (the fiber).

A removal of non-volatile material from a solution may be effected (a) by precipitation on a solid as in the case of sulfuric acid acting on calcium hydroxide present in excess of its solubility, or (b) by absorption because of surface forces as the removal of alkaloids by porous charcoal, or clay, or (c) by a process of solution, in a better solvent, nearly insoluble in the first. This last is not a change from one phase to another, unless the second solvent is a solid, in which case we are dealing with a solid solution.

Dyeing has characteristics that resemble the three methods of concentration of an organic substance. Consider a direct dyeing of cotton. The solid fiber is brought into contact with the dye solution at a temperature somewhere near the boil and the bath is modified by the addition of salt. After some time the temperature is lowered and the goods allowed to stand before removal and rinsing:

Dye on Fiber (Solid Phase) $\rightleftarrows$ Dye in Solution (Liquid Phase)

The end point in this system depends on

1. The nature of the fiber
2. The nature of the dye
3. The temperature
4. The concentration of the dyebath
5. The presence of electrolytes and their concentration
6. The pH of the dyebath.

Taking each one of these in turn further facts may be grouped:

1. The nature of the fiber: While it is obvious that major differences in fiber, even within the cellulose group, should alter the end result, all other combinations remaining constant, it is surprising to find how sensitive the result is to what appear to be minor differences. One would expect a dyeing on viscose rayon to be very different from one on plain cotton, different in shade, evenness or speed of dyeing, but one would hardly expect the very obvious effect produced by altering the tension on one and the same yarn at the moment of dyeing. Here there can be no alteration in chemical property but merely an alteration in the available surfaces, presumably a matter of mechanical condition.

This fact would tend to place dyeing in the category of a plain absorption, it would be like altering the surface condition of an absorbent carbon, since tension reduces the speed of dyeing and also decreases the total amount of dye absorbed from a bath containing an excess of dye. This is after allowing for the mere mechanical hindrance caused by the thread packing.

2. The composition of the dye is very vital to the process of direct dyeing, but no very definite correlation between constitution and affinity has been possible. However, it is certain that there are molecular structures favoring the absorption of a dye by cellulosic fibers. Differences varying all the way from essentially no affinity to very great are known to be due to no other factor than the molecular structure. These differences are independent of the solubility, sensitiveness to coagulation by electrolytes, or particle size. The benzidine, the J-acid urea, the benzoyl J, the thiazine groups all confer direct dyeing qualities. These facts would tend to justify a chemical or configurational view of the dyeing process.

3. Dyeing is extremely sensitive to temperature—it precedes extremely slowly at room temperature but very rapidly at 85° to 90° C. In this it resembles a chemical reaction.

4. The concentration of the dye bath is most important as might be expected. The rapidity of dyeing in relation to total amount of dye present is naturally greater when little dye is present, that is, the dye present is used up faster, the strength of the dyeing, however, rises directly as the concentration of the dyebath.

*Presented at meeting, New York Section, February 27, 1942.

5. Perhaps the most characteristic feature of direct dyeing is the extreme sensitiveness of the system to the presence of electrolytes dissolved in the dyebath. A solution of a pure dye, as the sodium salt, can be placed in contact with pure cellulosic fibers under typical dyeing conditions and there will be no adsorption but the addition of a mere trace of a soduim salt will cause immediate pick-up of dye. If, however, more and more salt is added the dyeing will improve up to a certain point and will then grow poorer, until the dye actually precipitates out. This fact is extremely important and must be explained by any tenable theory of dyeing.

The addition of the electrolyte may act in more than one way:

1. It may increase the aggregation of the dye molecules to larger micelles.
2. It may alter the charge upon the fiber by furnishing cations to be absorbed.

The effect of electrolytes is so obvious that it has been used to build theories covering all the observed facts. Thus it has been argued that if the effect of electrolytes is to increase molecular aggregation then may not the "power to dye" be a direct outcome of the particle size of the dye. This view has much in its favor. There is no more obvious difference between acid dyes that leave cotton uncolored in a neutral or alkaline bath even when an electrolyte is present and direct dyes than this of particle size. Acid dyes are essentially monomolecular in solution; direct always more or less colloidal. Also the fact that pure direct dyes with no electrolytes present are nearly monomolecular and that they do not dye, is enough to relate particle size to substantivity. The fact that the addition of an increasing concentration of salt is associated first with a greater intensity of dyeing and then with a diminution until total failure to dye results is also very simply explained by saying that there is an optimum size and that finally the aggregation reaches the point of excessive size. Undoubtedly particle size is of basic importance and it is possible to define the magnitude associated with substantivity. However, this is not the whole story because:

1. It is quite possible to produce micelles from acid dyeing dyes that lie within the dyeing range of particle size without obtaining direct dyeings.

2. A solution of a direct dyeing color rendered unsuited to dyeing by the addition of excess electrolyte can be prepared with the certainty that there are in it a certain percentage of dyeing size particles and yet no dyeing will take place.

The charge upon the fiber is also important and it is certain that the primary preferential adsorption of one of the ions of the electrolyte is largely responsible for the adsorption of the colored anion of the direct dye. The active groups in cotton and rayon are very feebly negative, very weakly acidic hydroxyl groups and these would pick-up sodium ions thus rendering the whole fibers more positive in charge, a condition that would lead to the deposition of anions or negatively charged colloidal dye micelles. One cannot be too dogmatic about the condition of the colored particle that is attracted and "fixed"; there is evidence that points strongly to the fact that it is the molecular units in equilibrium with the aggregated dye micelles that are absorbed and that these aggregate again within the fiber. More and more the evidence tends to show that whatever attaches itself to the fiber must at that moment, be in a monomolecular state. Another important characteristic of direct dyeing deserves consideration and that is that the shape of the dye molecule seems to be of definite significance. It has been possible to make colored molecules essentially identical in degree of dispersion and in molecular weight; dyes resembling each other very closely in the active radicals they contain and yet one has dyed, the other not, and there was enough evidence to allow the assumption, and it is purely an assumption, that the structure of cellulose is sufficiently rigid to make the necessary close contact with the dye molecules subject to some kind of hindrance. This is not to be interpreted too literally, all that is assumed is that the dye molecule when it is finally attached to the cellulose fiber adheres because of points of attraction on the molecules concerned and that if these points cannot approach closely enough because of the relatively rigid architecture of the molecules then dyeing is prevented. A "long" molecule with active groups spaced along its "axis" seems best able to form attachment to cellulose for example derivatives of benzidine, the urea of J-acid, benzoyl J-acid, etc.

6. The pH of the dyebath is important because direct dyes are properly soluble only in neutral or alkaline solution.

There are certain characteristics of direct dyeing that should be borne in mind when trying to interpret the process by any kind of a mechanical theory.

1. All direct dyeings are reversible under the conditions of the dyeing but the equilibrium differs enormously in the distribution of its terms using different dyes. It may be no more than a 10 to 1 ratio in favor of adsorbed dye or it may be 500 to 1. In general the dyeing process can be described in the same terms as the take-up of a gas by a porous solid (carbon black). The reversal of the adsorption is always favored by any process tending to dissociate the dye aggregate; heat, freedom from electrolyte, high dilution.

This characteristic of equilibrium does not invalidate any assumption of a chemical union between dyes and fiber but it does show that it cannot be a very strong one. What can be assumed regarding the dyeing process, considering only the case of direct dyes on cotton and viscose? The writer would lean to the following:

SUMMARY

1. The first step is the entrance of the most highly dissociated dye particles into the fiber (the approach of

the more highly aggregated dye micelles is of very little import to the process). The dye, having penetrated, is attracted strongly to the "walls" of the cellulose fiber which has become more positive because it has adsorbed the cations of the salt or dye. It is at this point that the process takes place that is the real cause of direct dyeing. It has been assumed that the dye molecules, attracted by the positive field existing about the reactive areas in the cellulose micelle, become attached to the cellulose by van der Waal's forces and this is in effect what happens, but I should like to point out that there is such an enormous spread in the amount of dye fixed comparing one dye to another, and there is such an enormous difference in the firmness of fixation that it seems inadequate to assume the attractive forces to be constant as they must be if the condition on the fiber is alone of moment. What I think should be given attention is the attractive force holding the dye molecules together once they approach each other as closely as they can under the orientating influence of the attractive forces along the cellulose molecule. Immediately surrounding the surface of the cellulose the electrolyte concentration will be higher because there will be some adsorption and this will tend to cause aggregation to a greater extent on or near the surface than in the solution. If we assume that conditions are such that the dye in the monomolecular condition diffuses into the intra micellar space and that there it is anchored to the surface by van der Waal's forces, which we know can be very powerful, and at the same time is orientated so that the maximum firmness of union between neighboring dye molecules results, we can see why the dye is removed from the dyebath and "fixed" on the fiber. This fixation is never complete but can approach completion very nearly, if there is no excess of dye over the capacity of the surface to absorb.

An extreme case is that of the leuco compounds of the anthraquinone vat dyes, these are essentially direct dyes but they are practically completely withdrawn from solution and their removal from the fiber requires quantities of dyebath quite beyond anything practical. Of course, in this case the dye being present as an insoluble pigment, pure hot water cannot be used, it being necessary to have alkali and hydrosulfite present to obtain the leuco. It would be interesting to reduce the dye on the fiber using hydrogenation in the presence of just enough sodium hydroxide to produce the sodium salt of the leuco. This should result in a more rapid removal of the dye from the fiber to the solution.

Viscose rayon differs in no essential respect from cotton as far as the dyeing process goes; it takes up color much more readily, being a degraded cellulose but the process of dyeing is not different.

Acetate rayon can be dyed as we all know, but the process by which the dye is fixed is entirely unlike that taking place in the case of cellulose. The fiber is of different mechanical construction; it does not show the same intramicellar spaces. Chemically it is also very different; the slightly acidic hydroxyl groups being converted to the extent of about 60% into ester groups lacking the mobile hydrogen of the (OH) group. The result is that most of the ordinary water soluble dyes do not show any affinity for the fiber, except for the basic dyes. Simple azo dyes soluble in alcohol do dye it. On the other hand, water insoluble dyes such as oil colors dye acetate yarn very readily, and it has been possible to select a very good line of dispersed dyes of a variety of classes, azo or aminoanthraquinone. In addition it has been found that dyes containing carboxyl groups and, therefore, water and alcohol soluble can be used. For blacks, soluble bases diazotized and developed on the fiber are used. The process of dyeing in this case appears to be one of solid solution. The dyeing is limited in intensity by the relative solubility of the dye in the bath and in the fiber. If, however, a second undyed skein is introduced, then this will take color from the first until the two are equally strong. This equalization takes place with a speed that is different for different dyes. In many cases it is complete in forty-five minutes, although the amount of dye leaving the dyed skein and entering the water is extremely minute, in fact not enough to be visible.

That this process is solely one of solid solution is not determined, in fact there is evidence to the contrary. The basicity of the colored molecules seems important as though there were a certain chemical valence effect, as well as mere solution. However, it is extremely difficult to find a method for distinguishing one cause from the other, since the solubility of a substance is frequently the summation of such forces and what may be called the purely molecular forces that cause one substance to mix with another as in a solution.

Wool—The dyeing of wool has been more thoroughly investigated than the dyeing of cotton. I think that the reason is to be found in the fact that wool being quite obviously chemically active, that is, containing acid and basic groups, there seemed some hope of success, while in the case of cotton the whole process of direct dyeing seemed beyond the field of any ordinary chemical process; cotton was neutral, the dyeing was done in a neutral solution, the whole process seemed irrational. This condition changed only when the field of colloidal chemistry and of X-ray analysis attained importance.

Wool always presented action; the affinity of this fiber for the early basic dyes was good; when the colorless bases were used they were changed into dye on the fiber; acid was required to force the early azo dyes onto the wool, and the azo chrome dyes sometimes changed color completely during the dyeing. All of this centered interest on a simple chemical explanation; the sulfuric acid liberated the acid of the dye and this reacted with the basic groups of the wool to give stable colored salts. There were many difficulties in fitting all the facts into so simple an explanation, but they were not allowed to assume great importance. For example, there was the case of the neutral dyeing milling colors. Why did these form stable complexes without any acid to liberate hydrogen ion?

Coming to our present views we may state that careful titrations of wool show that it is undoubtedly an ampholyte combining with acids at low pH's and with alkalies at high. We owe a gread deal of exact information to the careful work of Speakman. One result of this work was that the titration curve was found to be unlike the ordinary one obtained by the interaction of a base and an acid.

This brings me to a time when a new attack was made on this problem under circumstances that will bear recounting. During the last war it so happened that a large sum of money was obtained by a transaction involving the sale of reparation dyes, dyes furnished by Germany as a part of her penalty payments. It became a question how best to dispose of these moneys, and it was decided to devote them to the advantage of the whole textile industry to which end they were placed at the disposal of a Foundation chartered by Congress. This meant that the Textile Foundation, as it was called, was to administer the sums available to the advantage of the public, as a non-profit public institution. The administration was placed in the hands of three representatives of the textile industry, appointed by the President and the Secretaries of Commerce and Agriculture, ex officio. At first the effort was made to interest young research men in the textile field, very handsome fellowships were established at suitable seats of learning and young men appointed to them. In addition work was undertaken to analyze the economics of textile manufacture; this being assigned as a problem to the Wharton School of Business of the University of Pennsylvania.

For some years this plan was followed with considerable success, but it became increasingly evident that some more closely knit program of research was necessary. Finally a plan was adopted by which the Foundation was to spend a sum not to exceed $40,000 annually for three years, to foster pure research bearing on textile problems and the work was to be carried on at the National Bureau of Standards. Please understand that the whole project was not in any way governmental. The Bureau of Standards, cooperated by placing its facilities at the disposal of the Fellows, who were appointed, paid and controlled by those representing the Foundation. It was very encouraging to those responsible for advising the Board of Directors of the Foundation to find that research of this type, under these special conditions appealed very strongly to a number of excellent research men.

Ever since that time the work turned out has grown in importance until now we can say that some of the best and most important investigation being done anywhere in the world in this field is coming from the group in Washington.

My reason for referring to this matter is that it is an excellent chance to point out that pure research is very well worthwhile and in many cases finds explanation for facts very difficult of elucidation by any practical approach but yet of very real practical value.

The first broad research plan was to try to determine the real activity of the textile fibers in order to learn more of the nature of their breakdown, and of their behavior during processing. The combining activity of wool was an early object of investigation. It was a revival of work that had been done much earlier and done very well. Thus it seemed rather an unreasonable assumption to expect much more than a confirmation of the work of others, however, it is a truth known to every director of research that even the simplest problem is not approached in the same way by two men and that if they are capable of original thinking their methods may lead to very different results without either being wrong.

It so happened that Dr. Steinhardt who was entrusted with this work was a physical chemist in the field of biological chemistry. To him a wool fiber was nothing but a protein that had an unique advantage over egg-albumin, let us say, because it was in the solid phase and its active groups were fixed in space and in relation to each other.

The result of the work done in Washington is the introduction of a new concept in the mechanism of the dyeing of wool. In the past attention has always been focussed on the H-ion of the acid and the anion of the dye. Steinhardt was able to show that the anion of the acid plays an even more important role than the cation. He proved that the anion is attracted to the basic groups in the wool and that in consequence more hydrogen ion is absorbed but that the balance between anion and fiber is an independent equilibrium. Moreover the equilibrium is dependent on a factor, not mere acid intensity, that varies for each anion. In general as the molecular weight increases the relative quantity of anion adsorbed rises, but there are other factors one of which appears to be molecular shape, long molecules being better adsorbed than round ones. An acid dye, then, can be defined as a compound whose anion possesses a very high affinity for the active basic groups of wool. The difference in the values determined for different anions is very surprising. Thus hydrochloric acid and ethyl sulfuric acid show least combining affinity; the chloride ion being taken as unity then some other values are as follows:

H NO_3	3.2
Benzenesulfonic	3.9
o-Nitrobenzenesulfonic ..	11.0
2.4 Dinitrobenzenesulfonic	43
Picric	758
Flavianic	3020 — minimal value
Orange II acid....over	23400 at 50°

The enormous value for the simple sour dyeing color is very obviously a measure of its affinity. These affinity values rise with rising t°, therefore, dyeing is more rapid at higher t°s. The anion dissociation is exothermic and Steinhardt calculates 12,500 for Orange II at 25° under conditions by no means at equilibrium and, therefore, giving only a minimal value.

This is essentially a new approach to the theory of wool dyeing, it means that in the dyebath the anions are adsorbed, the most mobile and the most abundant first, usually sulfate ions. However, the affinity of these anions is low and the equilibrium is a rapidly moving one. The anions of the dye take their places in the exchange but can only adhere to the wool where the sulfate is gone. But the dye anions adhere very tenaciously; they are held by all kinds of secondary and primary valency forces that in sum represent the affinity; therefore more and more of them leave the dyebath and become a part of the solid phase, the fiber. If this description is correct the substitution of a colorless acid of lower anion affinity than the dye but greater than that of sulfuric should result in a more level dyeing because the colored dye anions would find it impossible to rush on. This actually can be demonstrated experimentally, using a naphthalene sulfonic acid.

Nylon—The latest novelties in the realm of textile fibers present new problems. I shall restrict myself to the case of nylon and ignore vinyon and the various forms of casein "wool." Nylon is a very simple amino acid protein in which the molecules consist of hydrocarbon chains of four, six or more methylene groups joined by the C = O NH group. For all practical purposes there are no other polar groups than these acid imides. One would expect such a molecule to be relatively inert, the greater part of the chain is surrounded by hydrogen atoms and offers no attractive fields, the —C(=O)—NH— groups are more acidic than basic, but not strongly either, and the mechanical structure of the fiber is sure to be much simpler than that of either cotton or wool. In fact nylon might be expected to resemble acetate rayon except in not being so acid. The conclusion would follow that the fiber could be dyed by a process similar to that used for acetate rayon, a kind of solid solution though the particular colored substances might be different. Actually all the acetate dyes can be used, but there are some surprises; the hues differ greatly on the two fibers, the acetate oranges become scarlet to reds; the reds, maroon, and violets become bluer, while the blues go greener. The fastness may be quite different. In general the fastness to light is poorer but here and there, there is a remarkable exception, the most striking of which is Acetamine Yellow CG which is very much faster on nylon than on acetate, while inversely Celanthrene Fast Yellow GL (Pat.) is faster on acetate than on nylon.

In one respect nylon differs from acetate rayon, and that is the case with which the dye leaves the fiber. I do not mean the fastness but the migration of the dye from colored to uncolored fiber until both are evenly dyed. This does take place when acetate rayon is used but it does so much quicker and more completely in a reasonable time on nylon. This fact is in favor of solid solution being the process of dyeing. If the distribution of the dye between dyebath and fiber takes place according to the law of partition then in every case equilibrium would result throughout the system in course of time. It really is surprising to find how quickly a dye dissolved in nylon leaves this fiber, wanders through the dyebath in which it is practically insoluble and then enters less highly colored fibers.

But nylon has other peculiarities, in spite of its indifference chemically, in spite of its hydrophobic character, it is dyed by water soluble dyes, if these are of the right "solubility." For example, the alcohol soluble acid dyes all color the fiber more or less strongly. However, they will not do so except from an acid solution. Here it cannot be that the acid is required to liberate the free dye acid, because a very little acetic acid is enough to cause fixation; in the case of the dye Anthraquinone Blue SKY, even boric acid acidity produces results. With the evidence presently available as a guide it seems to me probable that the fiber must be made less repellent by a surface adsorption of hydrogen ion at the —C(=O)—NH— link in order to allow the colored, anion to secure contact with the fiber in which it is to some extent soluble.

However, there is much that has no present explanation. Thus when acid dyes are applied from an acetic acid bath they dye but with this very interesting peculiarity. In the time available for dyeing they go on at very different rates to very different saturations. If a nylon fiber is dyed to "saturated" with one acid dye it becomes resisted to another. It is this that makes shade matching with acid dyes a nightmare. The dyes do not come to the fiber under conditions causing all of them to dye evenly and the one that gets there first keeps the next one off. Obviously if this is the case it is essentially impossible to do any touching up of a shade that is not quite a match for standard. If a nylon fiber dyed in a mixture of acid dyes is cross-sectioned and examined under the microscope it is found that the dyes have penetrated quite differently and there may be an outer brown ring, an inner green and still further in a yellow area.

The effect of nylon on vat dyes is very surprising; most of them show no affinity but those of them that do are robbed of their light fastness to an unbelievable extent; they are hardly more durable than basic dyes. The only possible explanation seems to me to be that the dyes are present so finely divided as to approach a condition of solution and, therefore, to be far more exposed to light than they are in the more or less pigmented form in which they are present in cotton or viscose after soaping. This is also true of azoic dyes.

All in all we are making progress in our understanding of the dyeing process; however, we have many problems still awaiting solution, each advance we make helps to satisfy our curiosity and fortunately also adds something to our technical control of one of the most important phases of textile finishing.

DISCUSSION

Chairman Tisdale: The idea has been brought forth, taking the case of a direct color approaching a cotton fiber, that it sees a little porthole, goes in, sort of makes itself at home, and gradually grows up. What would be the theory in the case of the direct color which is capable of being diazotized, for instance like primuline (which in the old days we used to put on silk) or like developing a naphthol? Would you consider the action which takes place an adsorption or is it a chemical attraction, inasmuch as I think the process or the color is not reversible afterwards? It is pretty well fixed. Is it a chemical or physical reaction?

Dr. Rose: The question is this: What happens when you take a dyeing with a dye that has no great affinity for the fiber and will wash off, and by treating it chemically on the fiber you convert it into a dye that doesn't wash off? You are doing two possible things. You may be simply making the molecules so large that they remain trapped or inert in the structure of the fiber, or you may be creating a molecule that has a great deal more tendency to form orientated aggregates with itself in which case you have a faster building up within the molecule. In some cases it is merely formation of pigment in the fiber that simply won't wash out. For instance, the azoic colors are like that.

Mr. Freeman: In your remarks about the nylon colors, the acid color dyeing of nylon, you mentioned something about their being soluble in alcohol. Is there any relationship between dyeing nylon and alcohol solubility?

Dr. Rose: Yes, to this extent: any color that dyes nylon more than superficially is sure to be soluble in alcohol. It doesn't follow, however, that every dye soluble in alcohol will dye nylon.

Member: Is it consistent with good practice in the dyeing of cotton to dye a cloth that has not been desized to get fast colors?

Dr. Rose: That is a mean question. Can you do it? If you can, it is consistent. (Laughter.) I should say that you are taking chances, but I don't see why you shouldn't do it.

Mr. Brosnan: Doctor, I should like to ask, in regard to nylon, if there are any colors or any groups of colors which exhibit fastness which is comparable to that of vat colors on cotton—I mean exceptional fastness to light and washing.

Dr. Rose: In a very few cases, yes, but they are dyes that do not produce heavy shades. For heavy shades, there are very few dyes available.

Mr. Brosnan: Any particular type of dyestuffs?

Dr. Rose: No, we are completely at sea there. We have just dim indications that we should be able to form some generalizations, but at present we don't have them.

Mr. Brosnan: Do you know that chrome dyestuffs, afterchromed—

Dr. Rose: The chrome dyestuffs would be beautiful on nylon if it weren't so difficult to get them to chrome. This is because the chrome is not soluble enough in the fiber to dissolve except after prolonged treatment. They produce a very nicely dyed fiber which is very fast.

Mr. Brosnan: How about colors like the Palatines?

Dr. Rose: They are no good at all. They just don't have enough affinity.

Chairman Tisdale: Is it possible to mordant the nylon with chrome and then apply alizarine colors?

Dr. Rose: Yes, that can be done.

Mr. Chairman, might I suggest that I should like very much to hear from my friend, Dr. Valko, to see whether he has some nasty criticism to make of my theory.

Dr. Valko: Mr. Chairman, Dr. Rose: It is like my experience the first time I went to the opera. I was so thrilled by the new experience that when I was asked how it was, I could only say that it was wonderful, and I could not make any critical remarks. That is about how I feel now. (Laughter and applause.)

I have read Dr. Rose's papers again and again for many years and I have learned a great deal from these papers. However, this was the first time that I had the opportunity to hear Dr. Rose.

When I try to get free from that impression and be really critical, then I have a feeling that we perhaps still have a certain tendency to over-emphasize the importance of some physical factors in dyeing. Colloid chemistry was, 20-30 years ago, a young science and at that time there was a general tendency to explain the dyeing phenomena as being colloidal phenomena, as coagulation of colloidal dye solutions. In the last ten years we gained a more chemical conception. In the colloid chemistry of 10 to 20 years ago there was much talk about the particle size of dyestuffs in dyeing solutions. Dr. Rose was the first who asked: What is the particle size in the dyeing solution? and who started to collect quantitative data on particle size in the dyebath. Also in other countries, especially in England and Germany, this was appreciated as a stimulating question and during the last few years a fairly large amount of data was accumulated on the particle size of acid, direct and vat dyestuffs. The general conclusion was a surprising one: In the dyebath we have aggregation but the dyestuff aggregates are very small, they contain on the average only very few molecules.

Consequently, as Dr. Rose stressed today, we have to assume that in the dyebath we have enough monomolecular dyestuff to go into the fiber and dye it. The excess of dyestuff that is present as an aggregate is merely a reservoir for the supply of the monomolecular form.

In the case of direct dyestuffs, Dr. Rose, in an ingenious way assumes that aggregation in the cellulose fibers takes place due to the locally high electrolyte concentration. This is an interesting suggestion. On the other hand, I think that we could explain the dyeing phenomenon of direct dyestuffs without assuming any aggregation in the fibers. We could regard the absorption of the dye as the

consequence of the specific affinity forces—similar to those between the acid dyestuffs and certain groups of the wool, which has been recently investigated in Washington, as mentioned by Dr. Rose. We suggested some time ago that these forces which act between the dyestuff and the hydroxyl groups of the cellulose are of the nature of the hydrogen bond.

The constitution of the dye molecules has a peculiar common feature, i.e., the presence of a long chain of conjugated double bonds. The quantum theory tells us that such chains have something that we can call a common electron cloud not belonging to any particular atom but belonging to the whole system of conjugated double bonds. It is quite possible that the hydrogen bond between the cellulose and the dyestuff is stabilized by this electron cloud. Thus the hydrogen bond and the nature of the conjugated double bonds represent the chemical or molecular-physical fundamental of the dyeing process.

There remains however, the question: what is the function of the salt in the dyeing phenomenon? I think the purpose of the presence of the salt is simply to eliminate the electrostatic repulsion between fiber and dyestuff. What is attracted by the cellulose in the hydrogen bonding is not the dye salt but only the dye anion. Even if the cellulose itself would not have any electric charge, the absorption of dye anion would accumulate a tremendous amount of negative charge on the cellulose. That is of course not possible, owing to the mutual repulsion between the negative charge of the cellulose and the negative charge of dye anions. However, with increase of the concentration of salt the electrical repulsion is gradually diminished and the chemical attraction between cellulose and dye can function without the electrical hindrance.

That is only a suggestion to explain the process of direct dyeing without assuming any aggregation in the fiber. As matter of fact, we tried to trace the aggregation of dyestuffs with X-ray diagrams. We found that even if 10 or 20 per cent direct dyestuff was taken up by the fiber, it did not reveal any diffraction lines characteristic of dye crystals. The finding however does not exclude the presence of amorphous aggregates.

This is all I would like to say in connection with the dyeing mechanism. However, I would like to ask Dr. Rose a question. Perhaps on economical reason it may be not possible on a thousand ton basis, but would it not be possible at least in the laboratory to introduce into the nylon molecule, by polymerization, a small quantity, say 1 per cent of an ammonium compound in order to secure an affinity for acid dyestuffs? (Applause.)

Dr. Rose: Dr. Valko, I should like to say one thing about your comments on direct dyeing. I don't think I was quite fair to what I was trying to explain. I did assume that in addition to aggregation there would be an orientation because of the counter attraction of the fiber and the dyestuff, which would have a tendency to place the dye in a secure position, and I think that is just as important as the aggregation, if the aggregation is important at all. And that is really a part of your idea.

As to the other, I think it might be done. I don't know. I am not very close to the gentlemen who are experimenting with nylon, but I think it would be possible. With regard to the ammonium compound in the fiber, it would be on one side of the fence and the dyestuff would be on the other side. You couldn't get the dyestuff to the ammonium compound. I think that this problem has given the nylon division so much thought that they probably have tried a number of ways of doing it.

Mr. Schmidt: Dr. Rose, you gave the six reasons why dyes dye. Which one of the six reasons is it when the dye doesn't dye uniformly? For example, if you are dyeing a piece of wool and rayon mixed, and the dye is heavier in the center than on either end, which one of the six would influence that?

Dr. Rose: You can pretty much take your choice. A little difference in the fiber character is one thing. If the temperature isn't absolutely uniform throughout, that might influence the result. Or again, if your concentration, because of ineffective stirring, is not right, that is quite effective in producing unlevelness. It is a sensitive equilibrium, and the really astonishing thing is that you get level dyeing when you do. It is surprising because the chances against it are tremendous.

Mr. Freedman: If the reaction is a chemical one, why does water have the property of leaching or separating the dyestuff from the fiber?

Dr. Rose: You mean in the case of a direct dye?

Mr. Freedman: On wools.

Dr. Rose: Well, you can easily think of cases where you have disassociation in the presence of water of compounds that are relatively stable without water being present, and if you assume that this compound we are talking about is more or less of the nature of a double salt, then water might very easily push the parts apart, and once they are apart they have no tendency to go back together unless the conditions are just right.

Dr. Meili: It is the general belief in dyeing acetate black on nylon, that you need a much greater amount of nitrite and acid to obtain a complete diazotization. Do you have an explanation of that, or is that actually true?

Dr. Rose: The developed colors would be beautiful on nylon if it weren't for two difficulties. One is that the base you wish to diazotize is much more soluble in nylon than the nitrite. Once the base is in, it is hard to get it out. It is also hard to get it completely diazotized. The nylon fiber is so extremely hydrophobic that your nitrite solution has to be used for a long time. You have to dye for an hour before you get really complete diazotization.

Member: Has any work been done on naphthols in applying them to nylon?

Dr. Rose: There are two difficulties. One is just the same as this one mentioned by Dr. Meili, that is, the difficulty of getting a proper coupling within the nylon fiber. You can get a very satisfactory color, but when you have it, the beautiful shade on nylon fades in light as fast as any basic color.

Mr. Kapelsohn: Do any of the dyes which show gas fading on acetate rayon show any similar type of fading when applied to nylon?

Dr. Rose: That is one of the things we have to explain. They don't. On nylon, they are perfectly fast. We don't know why.

Mr. Kapelsohn: Has there been any explanation of that?

Dr. Rose: Not the slightest at present. It is just a thing for which we can be thankful. (Laughter.)

SULFUR COLORS for the Army*

MAJOR FRANK M. STEADMAN
Quartermaster Depot, Philadelphia

MR. CRIST† has certainly presented his arguments very tellingly and with force, some of them very difficult to answer. However, there are certain factors in Federal procurement which differ from the normal methods of handling your commercial business interchanges. You are completely tied down with the so-called red tape which springs in general from Federal statutes which cover very completely all procurement agencies and especially that of the Army; the Army being one of the largest of the agencies governed, and especially so in time of war. This is especially true when we consider the procurements being conducted in the line of business in which you are engaged, textiles.

Consequently, it is of vital interest to us to make and to follow out these business interchanges in the manner contemplated by law. Frequently, unauthorized attempts to cut red tape result in ultimate claims which are carried through the Court of Claims. It involves seemingly endless litigation and in some of these cases where an attempt has been made to cut red tape, result in files of five and six inches in thickness. Now, all of that takes far more time, possibly, and more expense, than was saved in the attempt to cut the red tape. So that is the position of the procurement agents who are the contracting officers of the Quartermaster Corps, in dealing with industries. They are bound in their actions by the provisions of Federal statutes. Another factor which must be considered is that the contracting officers—as a matter of fact, all officers—are held personally responsible for their acts. It can come right back to the individual responsible; consequently, every procurement officer must necessarily proceed with caution.

As Mr. Crist has told you, there have been instances when the Army has suffered damage from sulfur dyestuff. Mr. Crist tells us that is not due to sulfur dyestuff. I think we can agree with him on that point. However, the fact that it results from failure to have the sulfur dyeing properly treated does come back to the fact that sulfur dyestuffs were used. Now all of you know, and we will agree, that sulfur colors, properly finished, are satisfactory for many uses; and there is little likelihood when they are properly finished of them resulting in eventual damage from deterioration and storage.

Mr. Crist has outlined a test procedure which we feel may give an answer for the procurement agencies in the consideration of dyestuffs. We are conducting a similar investigation. We are investigating other tests in addition to the oven test which he outlined, and are considering the simple pH determination test for sulfur dyestuffs, in the eventuality that we do turn to their use. But we will not turn to their use, if we can avoid it, until such time as those tests are worked out in sufficient detail so the procurement agencies may know before they effect their contracts that the interest of the Federal Government will be perfectly protected by adequate tests.

There are a number of applications where the use of sulfur dyestuffs may logically be considered at such time as the tests are worked out to everyone's satisfaction. Mr. Crist has mentioned bedding materials, and socks as being certain of those applications from which we should switch to sulfur colors, but as a matter of fact, we are not using the vat dyestuffs except on existing contracts. We have permitted direct dyestuffs so far as we could obtain the better dyes. Now, we appreciate the fact that these dyes do not have the color fastness desired; that they will not in all probability have the color fastness in many cases of the sulfur colors. However, we have moved to their use in order to ease the situation on vat colors. And it is probable we may be able to go to the use of sulfur colors for these applications at such time as we have these tests to our general satisfaction.

On the question of the barracks' bags and work clothes, I want to correct one impression which you may have received. The barracks' bags have been of blue denim, so there is no reason so far as dyestuffs go of getting out of that material. On the other hand, there is—and I think I am violating no confidence in stating this—in all probability a change in the near future from the blue denim for barracks' bags to olive drab fabric, in an effort to procure barracks' bags which will harmonize with the uniform of the enlisted men. In years past, the fatigue clothing has been only for the use of what might be called working parties; the men who went to the motor sheds in more recent years, to clean up motor vehicles, or to the gun sheds to clean up the artillery pieces, or in time further back when men

*An informal discussion presented at meeting, Piedmont Section, January 24, 1942.

†See "The Place of Sulfur Colors in Our War Production," page P133, March 16th issue.

went to stables to care for horses. That is changed to quite an extent due to, in part, the popularity of herring-bone twill. There has been a general change and a great widening of the use of herring-bone twill, with which I think most of you are familiar. The herring-bone twill was adopted after extensive tests which indicated that it was the best fabric for mechanics' one-piece coveralls, or "suits, working, one-piece," the name by which they are called. The herring-bone twill suit is an item which has proved very popular with enlisted men. As a matter of fact, I have been told that every effort is made by every man in the outfit to be a mechanic in order that he might be able to obtain a suit of herring-bone twill. The old plain waist band, blue denim trousers, have been changed to trousers of the herring-bone twill, made over the same pattern and same line as cotton uniform trousers. With those, the man is issued a herring-bone twill jacket having a band at the waist, a reasonably short jacket; that, with the herring-bone field hat now constitutes the enlisted man's field uniform. That uniform is going to be much more widely worn than the blue denim as a field uniform; it will receive more severe treatment, exposure to weather, etc. Consequently, in so far as possible in spite of proposals made to sulfur dye herring-bone twill, it is our belief that if for no other reason than to maintain the morale, that item of fabric should be continued in vat color as long as possible. For other fabrics which are not components of the outer uniform, it is possible that we will be able to shift to sulfur colors in order to get better fastness than that which we are at present accepting.

Mr. Smith suggests that I mention the work which is being done on the olive drab worsted fabrics on the improvement of color fastness. I will touch briefly on that. I believe about a year ago that an A.A.T.C.C. committee was formed to determine the improvement, if any, that might be effected in the color fastness and uniformity of color of the enlisted men's worsted serge uniform. As a matter of fact, that uniform is the enlisted man's dress uniform. Consequently, we feel that if possible that should be made as uniform in color as we can reasonably obtain it. The consideration was that when the most suitable dyestuffs were determined to maintain the uniformity of color, and to maintain a uniform fade (for fade we must accept to some extent) it was thought we could improve the color fastness on the serge and in general improve our enlisted men's dress uniform; but it so happens that war has intervened, and it is probable we will not be able to carry the program into effect, though tremendous strides have been made in the accumulation of knowledge on the subject. However, it is hoped we may be able to place this into effect through co-operative committees of your Association and achieve the improvement in our Army uniform. One thought which applies to both the wool and cotton uniforms is this, that at such time as the war is over—and the sooner the better—the Army may expect to live in the present stock of materials on hand at the close of hostilities for possibly as much as twenty-five years. Of course, that is bad news for the textile men for it means a minimum of sales to the Army for quite a long while after the close of hostilities. We want to make every effort possible to maintain the quality of our Army clothing, so when it comes to an end and we have stock on which we must exist for quite a length of time, we will not have a motley looking army. There was considerable criticism after the last World War, and during the 20's on the appearance of the Army, due quite largely to this inescapable fact that they had to live on what was left from the previous war. Our future demands that we maintain a quality standard based quite largely on the letter as well as the spirit of maintaining the morale of the soldier at the highest point so that the soldier will feel like one; he will not act like one unless he feels like one, and he will not feel like one unless he looks like one.

REPORT FROM AATCC DELEGATES TO THE I. S. C. C.

THE American Association of Textile Chemists and Colorists has continued its interests in color and in the Inter-Society Color Council through the activities of its Committee on Color, all of whose members are delegates to the Inter-Society Color Council.

The following references to the activities of the Color Council have been published during the year 1941, in the section of the American Dyestuff Reporter devoted to the Proceedings of the A.A.T.C.C.

"Program of the Tenth Annual Meeting, Inter-Society Color Council," American Dyestuff Reporter *30*, 66-7 (1941).

"A 1941 Review of the Inter-Society Color Council," American Dyestuff Reporter *30*, 278 (1941).

"Report of the A.A.T.C.C. Delegates to the Inter-Society Color Council," American Dyestuff Reporter *30*, 278-9 (1941).

The 1941 Year Book of the A.A.T.C.C. contained (1) resume of the program of the technical session at the Tenth Annual Meeting of the Inter-Society Color Council, (2) an announcement of the official approval by the A.A.T.C.C. of the ISCC-NBS method of designating colors as a standard method for the presentation of textile color data, and (3) a bibliography of articles published during the previous years on the subject of color with special reference to textiles and dyes.

In July 1941, the A.A.T.C.C. appointed a committee to co-operate with the Quartermaster Corps of the War Department in an investigation aimed to improve the color fastness of woolen and worsted olive drab uniform fabrics. This committee prepared and tested approximately 150 special dyeings.

At the Annual Meeting of the A.A.T.C.C. on October 31, 1941, Dr. S. Q. Duntley presented a paper entitled

"The Prediction and Control of Colored Fiber Blends by Optical Means." This paper was published in Am. Dyestuff Reptr. *30*, 698-700 (1941).

The Committee on Color of the A.A.T.C.C. is at the present time developing suitable specifications for standard illuminants to be used in the matching and judging of colors on textiles. It is also recommending that the A.A.T.C.C. approve the American Defense Emergency Standard dealing with the Specification and Description of Color which was proposed by the American Standards Association on January 1, 1942.

The A.A.T.C.C. delegates are continuing to recommend that this association maintain active participation as a member-body in the Inter-Society Color Council.

THE 1941 ACTIVITIES OF THE INTER-SOCIETY COLOR COUNCIL

A report presented at the 11th Annual Meeting of the I.S.C.C., February 26, 1942

IT is my pleasant duty at this time to review briefly the accomplishments and activities for the year 1941, a year marked throughout the land by transition from peacetime to defense and war activities—a transition which we may expect will continue. The effect of this transition on color interests may be traced in our News Letter which has contained many items bearing directly on the connection of color to our war effort.

Many of our activities seem to have no direct connection with the war effort, but I present them without apology because in war time more than in peace time it is essential that people be able to understand one another quickly and clearly, and without exception the projects of the Council are such as to remove the barriers to free interchange of ideas and information about color.

As an example, may be cited the many reviews of scientific, technical and industrial articles on color ably prepared by our Editor, Dr. I. H. Godlove. Dr. Godlove has also organized a method whereby the great bulk of the current literature on color can be collected for listing in the News Letter. The last three issues show the result of this co-operative effort in the form of a bibliography of nearly 600 titles of recent articles. The publication of this bibliography is a great step toward promoting the practical application of color knowledge to the color problems arising in science, art, and industry.

As in 1940, again in 1941 the Council participated in two technical sessions on color. One of these, A Symposium on Color—Its Specification and Use in Evaluating the Appearance of Materials, was jointly sponsored by the American Society for Testing Materials as a part of their 1941 Spring meeting in Washington; the other, A Symposium on Color Standards and Measurements, was jointly sponsored by the American Ceramic Society as a part of their 43rd annual meeting in Baltimore.

The ISCC-NBS method of designating colors has achieved increasing acceptance not only by our member bodies, the National Formulary of the American Pharmaceutical Association, and the U. S. Pharmacopoeial Convention, at whose request the method was developed, but also for the designation of colors generally. The U. S. Department of Agriculture has prepared a publication, Preliminary Color Standards and Color Names for Soils, including a color chart showing central representatives for 56 of the ISCC-NBS color designations. This publication is now available from the Superintendent of Documents in Washington, D. C.

The testing division of the Technical Association of the Pulp and Paper Industry has been studying the applicability of these color designations to the colors developed by stains applied for identification to fibers used in making paper with the thought of using them in a revision of their present standard method for determining the fiber composition of paper. Finally a Proposed Specification and Description of Color, now under consideration by the American Standards Association, includes a recommendation of the ISCC-NBS method of designating color wherever general comprehensibility is desired, and precision is not important. This proposal, sponsored jointly by the General Electric Company and the Interchemical Corporation, quite properly emphasizes that the ISCC-NBS names are descriptive only, and are not adapted to sales promotion nor intended to replace names developed for that purpose, such as those of the Textile Color Card Association.

The intense and fruitful work of the sub-committee on development of a test for color aptitude has continued throughout 1941, and we expect to hear in detail about the results later today and tomorrow from the co-chairmen of the sub-committee Messrs. Dimick and Foss.

Finally, it is very encouraging to report that a start has been made toward a large-scale "meeting of the minds" of color technologists, scientists, and artists. The remaining sessions listed on the program of the meeting stand as evidence of this co-operation. We have a Technical Session on Color in Art Education, a Discussion Session partly devoted to the same subject, and a Popular Session under the direction of Mr. Harold C. Parks, chairman of our delegation from the American Artists Professional League. To bring science and technology into co-ordination with art is a task beset with many difficulties; but we would not be meeting here in the Metropolitan Museum of Art, if it were not true that some of these difficulties are melting away. We have a rare opportunity to take a great forward step at this two-day meeting. Let those of us who are artists be patient with the scientist who is slow to grasp ideas not succinctly expressed in word or formula; let those of us who are scientists make a sincere and appreciative effort to understand the problems of the art teacher and the color concepts of the artist. Exhibits have been prepared to assist this understanding. Every effort will be made to bring out into open discussion the real difficulties which becloud the issues and to develop a mutual comprehension of them without which there can

be no real co-ordination between these diverse color groups such as it is the primary purpose of the Council to foster.

MEETING, PHILADELPHIA SECTION

THE last meeting of the Philadelphia Section was held on April 10th in the Mirror Room of the Hotel Philadelphia, preceded by an informal dinner.

Mr. Heard introduced the first speaker of the evening, George T. Vincent, who gave a talk on "Textone," a bleaching compound used in conjunction with Hypochlorite and a detergent. The pH value, once decided upon, can be controlled very easily as pointed out by Mr. Vincent.

Ira Thomas, Baseball Scout, who was scheduled to be at this meeting was unable to attend. In his place, Mr. Jones introduced John Da Grosa who is a former Colgate All-American, 1925. Mr. Da Grosa is a coach, lecturer and author on football, and is assistant to John B. Kelly in the Hale America Program, in charge of Industrial Activities and Sports. His talk was on physical fitness and its relationship to the National Defense Program. Keeping strictly on the line of athletics, he spoke on three parts:—

1—Army mechanization
2—Army of Production
3—Army of Civilian Defense

and stressed the fact that we are today in a game similar to basketball, football or baseball. He gave several excellent illustrations and closed his talk by quoting part of a letter written by one of the officers who went down on the Oklahoma at Pearl Harbor. The officer had written, "When we used to play a game we played to win—now we play to kill; *but this is a game in which there are no second plays.*"

Motion pictures were shown afterwards illustrating various high points of baseball during 1941.

The names of the chairmen elected to serve on the various committees for the annual meeting on October 15th, 16th and 17th, were read*

It was announced that the annual outing would be held on June 12th at the Manufacturers' Country Club.

Seventy members and twenty visitors were present.

Respectfully submitted,

BOYCE C. BOND, *Secretary.*

MEETINGS, NORTHERN NEW ENGLAND SECTION

November, 1941, Meeting

THE first meeting of the 1941-42 season was held on Friday evening, November 14, 1941, at the University Club in Boston. There were seventy-five members present at the dinner and an additional twenty members attended the business meeting and technical program which followed.

At the business meeting John N. Dalton, Chairman, called upon Clarence L. Nutting, Councilor, who gave a detailed report of the Council meeting held at Pinehurst on the occasion of the Annual Meeting of the Association.

The technical program for the evening comprised a description of the electron microscope and other research tools. The speaker was Dr. R. Bowling Barnes, Director of the Physics Division of the Stamford Laboratories of the American Cyanamid Company.

Dr. Barnes handled the difficult subject with ease and clarity, especially in describing the electron microscope. He explained that in the electron microscope a stream of electrons are shot by a suitable electrical apparatus into a vacuum through the sample to be examined between electro magnets, spaced about as are lenses in the regular microscope, to a photographic plate at the bottom of the evacuated space. Magnifications of 10,000 to 20,000 times are thus secured, 50 to 100 times as much as with the best ordinary microscope. The limit of detection by the ordinary microscope is a particle measuring 1,200 Angstrom units, by the electron microscope, as low as 20 to 30 Angstrom units. (Angstrom unit $= 1 \times 10^{-10}$ meter or 0.003937 millionth of an inch.) The possibilities of the electron microscope and comparison with the ordinary microscope were strikingly shown by a series of well-selected slides.

Another feature of the meeting was the showing, through the courtesy of the General Electric Company, of a sound film, entitled, "Curves of Color." This film explained and illustrated the latest researches of the General Electric Company in the measurement of light reflected from colored materials; especially covering the principle and use of the spectrophotometer.

December, 1941, Meeting

The meeting was held on December 12, 1941, at the Hotel Manger, Boston. There were seventy-eight members present at the dinner; an even hundred attended the business and technical session which followed.

The speaker of the evening was Dr. Siebert Q. Duntley, of the Massachusetts Institute of Technology, who discussed the subject, "The Prediction and Control of Colored Blends by Optical Means." This was an elaboration of the paper presented by Dr. Duntley and Frank J. O'Neil at the Intersectional Contest at Pinehurst. Many interesting experiments were performed to illustrate the principle of the program proposed and the use of the spectrophotometer in controlling shades under mill conditions.

Dr. Duntley was assisted by Frank J. O'Neil, who had prepared a series of exhibits illustrating the use of the spectrophotometer in the blending of pads to match various shades submitted to a woolen and worsted mill. One match in particular evoked much interest because it was necessary to measure spectrophotometrically the curves of five different dyes to secure the desired result.

Respectfully submitted,

EDWARD S. CHAPIN, *Secretary.*

*The dates have now been changed to October 9th, 10th and 11th.

OBITUARY

W. H. FIELDHOUSE

W. H. FIELDHOUSE, who was for many years active in the dyestuff field, died in San Francisco, California, on March 20, 1942, at the age of 81.

W. H. Fieldhouse

Mr. Fieldhouse was born in Barnard Castle, Yorkshire, England. He was educated as a pharmacist but, upon graduation, entered his father's woolen mill as a dyer. He came to the United States shortly after that and was associated with his brother in a woolen mill in Barrie, Illinois and from there went to the Jacksonville Woolen Mill in Jacksonville, Illinois. In 1893 he joined the firm of Pickhardt & Kuttroff as a dyestuff salesman and in 1900 opened the San Francisco office of the same company. When that office was closed he went to Montreal, Canada, in 1906 and for two years was manager for Canada of the Continental Colour & Chemical Company. When this company was dissolved in the winter of 1908, he was made manager of the textile division of the Badische Company in New York and remained with them until about 1911. Following that he spent some time in California and then returned, during to war, to Boston where he joined F. E. Atteaux & Co., later becoming sales manager for that firm. Following this he was with Aniline Dyes and Chemicals, Inc., predecessor of Ciba Co., Inc., as sales manager. He remained until the time of his retirement in 1919 and has since lived on the west coast.

Mr. Fieldhouse was well known to many friends in the textile and dyestuff fields for his genial and lovable personality and his keen sense of humor which remained with him to the end. Readers will recall the photograph of Mr. and Mrs. Fieldhouse appearing in the REPORTER on the occasion of their fifty-fourth wedding anniversary on August 18th, 1940, which typified his kindly graciousness.

His son, C. B. Fieldhouse, is general manager for Ciba Company, Ltd., in Montreal, Canada.

• SHATTER-PROOFING GLASS

Two companies have recently developed products for application to glass to prevent shattering during air raid bombings.

The Wilbur & Williams Company, Park Square Building, Boston, Mass., has recently developed a new transparent coating for this purpose. The material comes in liquid form, ready for use, and can be applied by spraying or brushing. The resulting coating is said to pass sunlight with very little absorption and to weather well without discoloration. It can be washed whenever necessary. While not intended for long service on the exterior, where exposed to the weather, it is stated that it should give indefinite protection when applied on the interior. Factories which require window-glass paint in normal times for glare-reduction, may obtain a colored coating which combines glare-reduction with resistance to shattering.

The Arabol Mfg. Co., 110 East 42nd St., New York City, recommends the use of a net or cheesecloth backing applied with Arabol Shatterproof Paste. A backing of black opaque cloth may be used for combination blackout and shatterproofing. It is said to be easily applied and easily removed when necessary. It is stated that the paste itself is translucent, allowing a diffused daylight to come through. Among other advantages it is pointed out that the raw materials are not subject to priority and are readily available.

Complete details concerning either of these methods may be obtained from the manufacturers.

• GENERAL RELEASE

General Dyestuff Corp., 435 Hudson Street, New York City, has recently released a circular describing the following product:—

Indanthren Scarlet BBN Suprafix—a vat dyestuff specially adapted for printing. It is said to be in the form of a smooth, grit-free, non-settling paste. It prints bright shades of scarlet said to possess very good fastness to washing, chlorine and light. It is further said to be very well suited for use on draperies and other severely exposed fabrics. Circular G-287.

• COLORFASTNESS CONFERENCE

A trade practice conference under the auspices of the Federal Trade Commission was held in the Pennsylvania Hotel, New York City, on April 10th. Henry Miller, director of trade practice conferences, presided.

The proceedings, of which this conference was a part, are directed toward the establishment, subject to the Commission's approval, of comprehensive fair trade practice rules concerning the subject of colorfastness of textiles, thereby to provide for the elimination and prevention of advertising, labeling, and other marketing methods which are deceptive or misleading to the purchasing public or are otherwise unfair; to provide proper nomenclature to be made available for use in advertising or labeling products with respect to colorfastness or resistance to fading; to relate such nomenclature to proper test methods; and otherwise to provide rules for the prevention of unfair methods of competition and unfair or deceptive acts or practices in regard to the subject.

Before final approval of rules, all suggestions and proposals presented will be given consideration by the Commission. Thereupon a draft of proposed rules in proper form will be prepared and made available by the Commission upon public notice affording all interested or affected parties opportunity to study the proposed rules and to present their views together with any suggestions, amendments, or objections which they might desire to submit, and to be heard regarding the matter. Thus, before rules are finally approved and put into effect, further opportunity to be heard in the proceedings will be afforded to all concerned, including representatives of consumers, of scientific or technical organizations, as well as of the industries, trades, and other agencies or persons concerned.

The co-operation and assistance of all interested or affected parties is desired in working out constructive rules on the subject.

• A.I.C. MEDAL

The medal of The American Institute of Chemists, presented annually for outstanding service to the science of chemistry and the profession of chemist in America, will be awarded this year to Dr. William Lloyd Evans, chairman of the Department of Chemistry, and professor emeritus, of Ohio State University, Columbus Ohio according to an announcement made recently by President Harry L. Fisher, from the Institute's Office at 233 Broadway, New York, N. Y.

The award is made in recognition of Dr. Evans' outstanding accomplishments in

the field of oxidation of organic compounds, particularly in the oxidation of carbohydrates; and for his contributions to the profession as an educator.

The medal will be presented to Dr. Evans at the Annual Meeting of The American Institute of Chemists to be held on May 16, 1942, at the Claridge Hotel, Atlantic City, New Jersey.

• JOINS HOOKER

William F. George, associated with *Chemical Industries* for many years, has joined the Sales Organization of the Hooker Electrochemical Company. This company has its principal offices at Niagara Falls, New York. Mr. George will be in charge of their New York Office located in the Lincoln Building at 60 East 42nd Street. He will devote his efforts generally to trade contacts in the Metropolitan New York area.

At one time he was connected with the Hooker Company at their plant in Niagara Falls, New York, and later in their New York sales office. He left in 1919 to organize the firm of W. F. George Chemicals, Inc., now known as George Chemical Company which business he conducted until 1928 when he went with *Chemical Industries*.

• AMMONIA PLANT

Plans for the immediate erection of a plant that will substantially increase the supply of ammonia and its derivatives were announced recently by E. M. Allen, president of the Mathieson Alkali Works, Inc., New York.

In accordance with the terms of a contract that has just been signed, the new plant will be financed by the Defense Plant Corporation and will be erected and operated under lease by the Mathieson organization, Mr. Allen stated. The ammonia will be produced synthetically, through the use of a modification of existing methods, by combining hydrogen with nitrogen obtained from the air.

• RAYON STAPLE FIBER

World production of rayon staple fiber totaled approximately one and a half billion pounds in 1941, which represented more than a 200-fold increase over the 1929 production of 7,185,000 pounds, according to Rene Bouvet of the American Viscose Corporation, who recently spoke on "Rayon Staple Fiber Spinning" before the American Association of Textile Technologists meeting at the Builders Club, New York. United States production of rayon staple fiber in 1941 reached 122,000,000 pounds, or approximately 8 per cent of the world total.

"The versatility of rayon staple fiber is endless, its potentialities hardly explored, and its present achievements may be regarded as a modest beginning of what the future holds," Mr. Bouvet stated. "In spite of being but three decades old, it already occupies a remarkable place in the textile field. It has achieved notable success, not only in the dress goods line, but for men's and women's wear, blankets, rugs, and in countless other branches. Its expanding use is being accelerated by the public demand as well as the war tempo.

"With comparatively few changes, existing cotton machinery can be used for the processing of rayon staple fiber. The woolen and worsted industries already use it in large quantities and are anxious to see their allotments increased. Blends comprising 50 per cent of rayon and 50 per cent of wool are being spun very successfully on the cotton system. This gives but one illustration of how helpful rayon staple fiber may be at times like these when it is found necessary to make our wool stock go a long way."

• CONVERTS TEXTILE PLANT

Conversion of a long idle textile processing plant in Sunbury, Pa., to manufacture bulkier types of communication facilities for the Government was announced by Walter C. Evans, general manager of the Westinghouse Broadcasting, Radio and X-ray Divisions. The plant was formerly used by the Sunbury Converting Works for printing patterns on silk cloth.

Rehabilitating and equipping were begun in March with manufacturing operations scheduled to start soon. Approximately 400 persons will be employed at the start, but ultimately this number will be considerably increased. Twenty per cent of the employes will be women.

The decision to locate in Sunbury was made because the plant had idle facilities which could be converted quickly to aid the nation's war effort. In addition, Sunbury has the skilled workers needed. Principal skills required are factory maintenance personnel, machine tool operators, assemblers, wiremen and wood workers. Initial force of employes for the plant rehabilitation program will include millwrights, mechanics and pipe fitters.

• APRIL TEXTILE RESEARCH

Use of fluorescent lamps in making photomicrographs of textiles, and fundamental and applied research on latex which led to development of fine elastic yarns and fabrics with two-way stretch are described in the April issue of *Textile Research*, official publication of Textile Research Institute, Inc., and the Textile Foundation. Use of fluorescent lamps in textile photomicrography has several advantages, according to an article by Henry H. Broadfoot and Edward R. Schwarz, of the Textile Division, Massachusetts Institute of Technology. Fluorescent lighting avoids over-heating of the specimen, uneven lighting, and streaks. The tubes and reflectors are inexpensive and the lamps consume little electric energy. Fluorescent lighting is particularly advantageous in making photomicrographs of relatively small magnification, such as those used for recording defects in textiles.

Fundamental and applied research on latex, carried out by United States Rubber Co., led to the development of an elastic yarn of such fineness that it could be knit on fine-gauge machines or woven into sheer fabrics. This yarn, known as Lastex, was quickly adopted by the textile industry for use alone or in combination with non-elastic yarns in a wide variety of fabrics, including bathing suits, foundation garments, socks and anklets with self-supporting tops, dress goods, sweaters, upholstery fabrics, slip covers, tapes, and braids. Temporarily, little latex or rubber is available for civilian purposes; but research on production of elastic yarns has not stopped, and when the war is over elastic yarns even better than those produced hitherto will be made available to the textile industry.

Among other features of the April issue of *Textile Research* are a research report of the results on cotton yarn appearance and strength obtained by increasing card speeds; descriptions of new tests for determining the percentage of casein fiber present in mixed goods and for determining the amount of tendering which will take place in sulfur-dyed yarns and fabrics under ordinary storage conditions; and a discussion of the value of business research as it relates to marketing, industrial relations, and public relations.

• WARP SIZING RESEARCH

Plans for broadening the scope of the research on warp sizing of spun rayon yarns now being carried out under the auspices of Textile Research Institute, Inc., were formulated at a conference just held in Washington. Fifty representatives of textile mills, manufacturers of sizing materials, and machinery companies attended the conference, which was called by Edward T. Pickard, executive secretary of the Institute.

It was generally felt that the practical experiments on sizing spun rayon warps now being conducted at North Carolina State College Textile School should be supplemented by fundamental studies on properties of sizing materials. Possibility of further extending the investigation to include blended yarns containing spun rayon in admixture with other fibers was also suggested.

Preceding the informal discussion, Prof. William E. Shinn, who is supervising the co-operative research on warp sizing which is being carried out under the auspices of the Institute at North Carolina State College, outlined the work completed to date and stated that six confidential reports have been issued to subscribers. Dean Thomas Nelson described research facilities of State

College Textile School; these include a 5-cylinder rayon slasher, a miniature slasher, and a wide variety of testing equipment.

Warp sizing of spun rayon as carried out today is largely an empirical procedure, according to Dr. Milton Harris, director of research of Textile Research Institute, Inc. Fundamental research on the adhesiveness, strength, flexibility, film-forming, and other properties of sizing materials should yield data which would permit the setting up of specifications for sizes which would give satisfactory results from the standpoint of both the weaver and the finisher.

Dr. William E. Yelland, of Corn Products Refining Company, discussed the role of starch and starch derivatives in warp sizing of spun rayon; and Dr. Donald H. Powers, of Rohm & Haas Company, described the use of water-soluble and water-insoluble synthetic resins as sizing materials.

In the informal discussion it was emphasized by several speakers that two of the most important problems from the viewpoint of mill men are excessive shedding of the sized warps, and defects in finishing due to difficulty in removing all the size before dyeing. Consensus of those attending the conference was that the applied research should be continued, with the emphasis on solution of the more immediate problems, and that simultaneously investigations of a more fundamental nature should be undertaken for the purpose of developing basic data on the properties of sizing materials. William D. Appel, chairman of the Institute's Technical Research Committee, presided.

The conferees were luncheon guests of the Institute and of the Textile Foundation at the Shoreham Hotel. In the afternoon they visited the laboratories of the Institute and Foundation, and had an opportunity of examining their facilities and equipment and of viewing the work of the fourteen research fellows directed by Dr. Harris.

• CALCO BULLETINS

The Calco Chemical Division of the American Cyanamid Company announces three new bulletins which they have recently issued to the trade on the dyeing of textile fabrics for Government use.

The first technical bulletin—No. 637—covers the powder blue vat dyeing of nurses' cotton broadcloth waist material. The second bulletin—No. 638—covers the dyeing of dark blue worsted yarn for U. S. Navy jerseys. The third bulletin—No. 643—covers the dyeing of olive drab cotton socks with direct colors.

All of these bulletins list the Government specifications and requirements, as well as suggested dyeing formulae meeting these requirements.

Copies of these bulletins may be obtained by writing Calco's Advertising Department at Bound Brook, New Jersey.

• COLOR MATCHING UNIT

A practical color matching unit has been designed by The Frink Corp., Long Island City, N. Y., which is said to provide abundant color corrected light. The unit is equipped with a combination of incandescent and fluorescent light sources in such proportion, as to produce the desired color temperature.

A typical application of Frink color matching units for inspecting and matching textiles at the Titus Blatter Co., New York City. An illumination of 60 foot candles of color corrected light is provided below the units.

The large luminous areas provide a low surface brightness and produce a high level of illumination, said to be free from troublesome glare. The stroboscopic effect of the light source is equivalent to that of a 60-watt incandescent lamp. It is stated that the unit is easy to install and that it maintains and provides a most efficient light source for tasks involving color discrimination and inspection.

A twenty-four page brochure, describing engineering service and the complete line of fluorescent equipment, manufactured by The Frink Corporation, will be supplied upon request.

• TEXTILE RESEARCH FOR WAR

At a meeting of textile association officials, under the auspices of the Textile Research Institute and the Textile Foundation, held at the Roosevelt Hotel, New York, April 7th, a program was devised to step up the tempo of textile research to meet the new problems arising from war shortages of materials and labor.

The primary outcome of the meeting was the decision to set up a Textile Research War Council in which all interested groups will be represented. The function of this council will be to clear textile research problems involved in the war emergency, and to take steps toward the immediate solution of those problems.

• JOINS AMERICAN VISCOSE

Arthur R. Wachter has joined the American Viscose Corporation as head of the "Crown" Test Division, it was announced recently. Previously Mr. Wachter was for seven years manager of the rayon division of the print works of Pacific Mills, Inc., with headquarters at Lawrence, Mass., and prior to that was manager of the Williamsport, Pa., works of the National Silk Dyeing Co. In his new position, Mr. Wachter will supervise the American Viscose Corporation's "Crown" Tested Plan, under which fabrics woven or knitted from the Company's "Crown" brand rayon yarn and staple fiber are tested for service qualities.

• CELANESE PATENTS

Celanese Corporation of America this week was granted two United States Letters Patent relating to a process and apparatus for the stretching of artificial cellulose acetate yarns, foils and similar materials.

Patent No. 2,279,478 is predicated on the discovery that improved results, particularly as regards extensibility of the products, may be obtained in the stretching of travelling artificial filaments in the presence of steam if the filaments are conditioned in wet steam prior to the stretching operation.

Patent No. 2,279,479 is directed to apparatus for carrying out the above process. In addition to the usual stretching apparatus, it includes a container for the yarn or filament package which is provided with an inlet for wet steam and an outlet for the yarns or filaments in combination with a positively driven feed device.

• NEW DEFENSE COURSE IN TEXTILES

E. W. Ruggles, director of the defense courses conducted at North Carolina State College under the supervision of the United States Office of Education, has announced that the fifth course in Fabric Testing and Inspection will open on June 8 and run for twelve weeks. All expenses except board, room and rent and books are paid by the Federal Government.

Students who enroll in this course will be taught elementary textile design, fabric analysis, fabric calculations, the care and operation of fabric testing equipment, physical and chemical tests for the identification of textile fibers, as well as a study of yarn and fabric defects.

Mr. Ruggles says that this is an excellent opportunity for high school graduates who are now working in textile establishments to lay the foundation for future advancement in textile mills, and possibly to qualify for government service in the Quartermaster Corps as fabric inspectors.

Enrollment in the course is limited to 22, so applications should be sent in as soon as possible.

Annual Processing Review Number will appear October 12, 1942

The Dyeing of
WOMEN'S WARTIME HOSIERY

L. J. McGINTY
Nyanza Color & Chem. Co.

ADWINDLING in recent months of the types of yarns available for making women's hosiery has apparently simplified the dyer's job.

Silk and nylon are going or gone. All-silk and all-nylon constructions, the easiest to dye, were abandoned early by most mills. Both fibers were conserved by combining them in the stocking in a number of ways with cotton and different kinds of rayon. That, of course, meant trouble for the dyer.

But the disappearance of silk and nylon actually has brought no relief but more trouble. Although only cotton and rayon are left for women's hosiery, the varieties of cotton, natural and mercerized, and of viscose rayon and cupra rayon cannot be selectively dyed with respect to one another like silk or nylon; they have a common affinity for dyestuffs which, however, varies within very wide limits.

The situation has obviously been made much more difficult by the fact that the hosiery manufacturer has to take what cotton and rayon yarns he can get, in skimpy lots, and often from unfamiliar sources. There is no telling whose viscose rayon will hit the dyehouse next, or whether it will be high-luster, dull-luster or semi-dull, or what the denier, the number of filaments or the twist will be. About the time the dyer has mastered a certain style, one of the yarns is changed and he has a new and sometimes insoluble problem on his hands.

Most of the hosiery being knit at present is, (1) viscose-rayon-and-mercerized-cotton, (2) cupra-rayon-and-mercerized-cotton and to a somewhat lesser extent, (3) all-viscose rayon, (4) all-cupra rayon, (5) all-mercerized cotton and (6) all-natural cotton.

Before considering these different constructions in order as regards dyeing problems, it might be said that in general none of them presents unique or special scouring difficulties. Some mills scour before dyeing, others do not. Knitting lubricants and dirt need to be removed, but there is no critical shortage as yet of good detergents offered for this purpose. If the goods are not pre-scoured, a dye assistant having detergent properties can be used.

VISCOSE-RAYON-AND-MERCERIZED COTTON

In dyeing hosiery of this make-up, choice of colors and of dyeing method are both highly important.

Practically all direct colors favor mercerized cotton over viscose rayon in light shades and favor the rayon in heavy shades. In more specific terms, a direct color, under given dyeing conditions, has one critical depth at which it dyes rayon and cotton with equal strength; below this depth it favors cotton, above it, rayon. There is no point here in taking saturated dyeings into account.

In a strictly relative sense, some colors show greater affinity for one or the other fiber. Typical of the colors favoring rayon are Benzo Fast Yellow RL (C.I. 349a), Benzo Fast Black L (Prototype 24), and Diamine Fast Red F (C.I. 419); in contrast with these, the following favor cotton: Sun Yellow (C.I. 620), Oxydiaminogen OB (Pr. 147) and Direct Fast Red 8BLN (C.I. 278).

Since a dye will produce an exact union at only one depth, and shade matching can be held to no such limitations, dyers sometimes find it expedient to use two reds or two yellows.

The best control of dyestuffs possible needs to take into account the method of dyeing. To get the maximum amount of color on the rayon, dyestuffs should be entered at a boil in a short bath and salted out quickly; if the dyeing is started at a low temperature, part of the salt should be added before the steam is turned on. The mercerized cotton, on the other hand, will absorb more color from a long bath with the dyestuff entered at a low temperature; the goods should be boiled some thirty minutes before adding salt, which is used sparingly.

In this type of hosiery, dyestuff affinity is complicated by variations in the cotton due to degrees of mercerization and in the rayon because of a number of differences, both technical and intrinsic. In general, the trend toward low lusters and high twists in rayon has reduced color absorption enough to cause considerable discomfort among hosiery dyers.

Sometimes the speed of exhaustion necessary for a good union does not permit proper seam penetration, even with the best available colors and penetrants. A combination of highly mercerized cotton and low-luster rayon often poses such a problem. It seems unlikely that there is any answer to this in the dyehouse. If the seams cannot be made looser or a different cotton yarn with less mercerization substituted, the union will have to be sacrificed.

CUPRA-RAYON-AND-MERCERIZED COTTON

In contrast with the foregoing types of viscose yarns, cupra rayon has dye affinity to spare. For this combination the cotton should be highly mercerized.

Dyestuff is usually entered at a boil. Cupra rayon seems to level best at this temperature. It is most receptive to color in the neighborhood of 160°, where some colors are absorbed as much as 50 per cent heavier than when added to a boiling bath. Dyestuffs vary in their union properties, rate of exhaustion and tendency to accentuate barré. The dyer generally finds it well worth the trouble to make a beaker dyeing of each color in order to appraise it at first hand before adopting it.

ALL-VISCOSE RAYON

One of the chief problems characterizing this style is an inclination to tangle badly and produce shaded goods. Rayon slides against rayon with a minimum of friction and the hose continue to snarl with every revolution of the dye tub. This is worse in lots too small for the capacity of the machine. By bagging the goods—which in itself reduces tangling—sizes in the small lots can be combined so that some pockets will be filled. If the hosiery is pre-scoured it should be shaken up before dyeing.

Dyestuff is added at a low temperature, raising to a boil, or added at a boil, but to anticipate tangling, salt should be added without unnecessary delay. Also, salt should be added slowly, especially the first portion, which exhausts relatively the most color.

If additions of dyestuff have to be made, it is generally best to drop the dyebath and untangle the hose. Light additions can then be made in a warm salt bath in the manner that silk hosiery is touched up in the finish bath.

ALL-CUPRA RAYON

If there is shading in this type of hosiery, it is most apt to occur when the dyestuff is first added. The stockings dye before there is time for very much tangling, and most of the color is exhausted before salt is introduced. Some dyers dispense with salt. The initial speed of exhaustion should be held down as much as possible through choice of colors.

ALL-MERCERIZED COTTON

Uneven mercerization shows up in the dyehouse as tiger-stripes or as several distinct shades in the same dye lot. The latter is extremely perplexing to the dyer because it is hard to identify positively. It looks like bad dyeing. As a result, many batches are reworked or stripped and redyed only to come up just about as they were before. Shading of this sort can be seen in the welts of combination styles, but attracts somewhat less attention than in all-mercerized numbers.

The dyer can have some control, though it is necessarily limited, over uneven mercerization. Dyestuffs are not all alike in their behavior toward mercerized as compared with natural yarn. The gaps in affinity vary. There may or may not be a change of tone. These characteristics can be brought out by dyeing a natural and a highly mercerized cotton skein together. Colors showing the least tone change and the least affinity gap would show correspondingly smaller tone changes and affinity gaps between lesser degrees of mercerization. A combination of such colors in approximately the same affinity zone would tend to reveal degrees of mercerization as variations of color depth rather than of color tone.

ALL-NATURAL COTTON

Yarn from a new source may cause some shade deviation here. However, this should be a minor problem in a well-run mill; if yarns from several different spinners are carelessly mingled in stock bins or knitting room, the dyer can usually exonerate himself by finding a dyed stocking in which the dissimilar yarns meet and display a sharp boundary line.

FINISHING

Finishing of the various styles of women's wartime hosiery has not as yet become standardized.

The finishing ingredients commonly adopted for silk were a splash-proof, a filler, a duller and sometimes a softener. Some mills use these products in a slightly revised formula for rayon hosiery, while others, running low-luster viscose yarns, use nothing at all. Another group of dyers use a filler without the splash-proof. Some type of duller is pretty sure to be used on the high-luster rayons, though extremely low luster is hard to get in this manner without causing chalkiness.

Cupra rayon goods have a marked harshness after dyeing by the usual methods. This can be improved by using a stearic acid type of softener in the dyebath or as a finish; however, cation active softeners have greater potency and are preferred by the majority of dyers.

Cotton hosiery is usually finished with some sort of filler. This may be ordinary corn starch for the cheaper naural cotton grades. For the finer mercerized grades, plain or mesh, some dyers use the same splash-proof and filler they formerly used for silk.

Finishing the Newer Types of RAYON HOSIERY—

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and by restricting the normal brilliance of the rayon, they render less apparent defects of construction.

Usually the waterproofing and dulling agents are so compounded that they supplement each other and form stable dispersions together in the finishing bath.

FINISHES DESIGNED TO ACCENTUATE OR RESTRICT SOME NATURAL RAYON PROPERTY

One of the important functions of textile finishing is to modify some inherent yarn characteristic. Trade characteristics often require modifications of the physical properties of yarns. Threads seldom possess the requisite touch, the proper degree of luster, or absorbency. These properties may be modified by the employment of finishes.

Hosiery prepared from rayon yarns is usually too lustrous and harsh to meet with popular approval, and it is the finishing operation upon which the dyer depends for a modification of the yarn.

The luster is usually subdued by dulling agents. Two general types of pigments are used, the organic types and those composed of inorganic pigments. The organic pigments are usually synthetic resin dispersions. They usually impart only a partial delustering effect which is frequently durable to washing. Alkyd resins and completely polymerized formaldehyde condensates are occasionally used to accomplish the purpose. However, the hosiery colors are frequently adversely affected by the resin and as a consequence are not in very general use.

The poly-functional inorganic pigment types are far more popular. As a class, they impart a great degree of dullness and are of aid in masking the structural imperfections of hose. They also blend easier with the conventional softening agents, invariably aid to plasticize film and body-forming sizes, and impart a softer handle to the hose.

Rayon yarns have always been somewhat deficient in softness, and the addition of some type of softening agent is usually required to produce an acceptable hose.

Although many types of oils, fat alcohols, raw or partially sulfated and cationic softness have proved effective, dyers usually strive to secure one which in addition to imparting a soft and pleasing hand will simultaneously blend or "marry" with the other finishing components plasticizing the film-forming size and be useful in lubricating the yarn. The higher sulfated oils and partially sulfated fat alcohols are particularly potent for this purpose, but inferior to the cationic softening agents.

Unfortunately, the cationic auxiliaries cannot be used with all classes of commercial finishes and are precipitated from solution by many anionic sizes. However, that class constitutes almost our only group of softeners that are resistant to washing, and where permanent finishes are demanded that group is almost a commercial necessity.

FINISHES DESIGNED TO IMPROVE THE WEAR OF HOSE

All classes of textiles are subject to the acquisition of defects incidental to wear. Among such defects may be included runs, "holes from picks," "pull threads," and abraded hose. A restriction to the formation of these blemishes has long been sought, and preventive finishes have been developed. It is obviously essential that such sizes be of the "permanent" type.

Probably none of the "natural sizes" possess the requisite durability. As a consequence, the newer synthetic resins are most useful for this type of work. The rapid evolution of these durable finishes has been temporarily terminated by military requirements for resins. It might be added, however, that various synthetics had already proved their merits as hosiery-sizing ingredients. Among such finishes may be listed certain latex complexes, the cellulosic ester and ethers, the alkyds and various formaldehyde condensates. Many of such finishes greatly extended the life and durability of hose, and it is to be regretted that the evolution of this rapidly developing field must await more peaceful times for its fruition.

FINISHES DESIGNED TO SIMULATE HAND AND APPEARANCE OF SUPERIOR QUALITY MERCHANDISE

There has always been a demand for a type of size or finish which when applied to fabrics would simulate the appearance and handle of more costly merchandise, thereby giving a false impression of quality. Such finishing effects are usually accomplished by the use of heavy film-forming sizes plasticized by suitable oils and waxes. The body-building sizes are generally various blends of gums, glues, and starches, and the plasticizer is one of the cheaper types of oil, wax, or lubricant. It is regrettable that dyers are inclined to select such finishes by cost consideration without regard to the influence of the finish on the durability of their creation. Many weight-building sizes are inclined to reduce the flexibility of hose fibers, and this deficiency is almost invariably reflected by runs in the hose, frequently after very short wear.

KNITTED GARMENTS Used by the United States Navy—

(Continued from page 200)

without seaming or sewing, allowing expansion to the full width of the fabric. The finished ribbed cuff measures 5½ inches long, with a tolerance of plus or minus ¼ inch permitted. The socks are made with a full size heel and toe, with the gore knit with not less than 28 needles for each side. The closing of the toe should be elastic, smooth, and free from lumps, laps, or dog ears. The toe has a ½ inch advanced or ring splicing. If a looping machine is use, it should be a two needle looper using a thread of yarn in each needle. The sole is reinforced, and the heel has a high splicing. The socks should be knit full so that they will finish to the proper size and length without stretching during boarding. The length of the foot is denoted by size, and each sock has the proper size stamped on the toe. A plus or minus tolerance of ¼ inch is allowed. The length of the leg from the extreme ribbed top to the lower edge of the heel must measure 14 inches for size 10 and under, 14½ inches for sizes 10½ to 13, and 15½ inches for size 13½ and up. A tolerance of plus or minus ½ inch is allowed. The socks are knitted with a loose elastic stitch so that the finished socks shall have good elasticity and be capable of being stretched with a slight amount of tension to widths, measured across the foot at a point midway between the toe and the heel, of not less than 6 inches for sizes 10½ and under and not less than 6½ inches for sizes over 10½ inches. The socks are dyed black, with a diazotized and developed direct dye, having fastness to light, laundering, crocking, and perspiration equal to the standard sample.

SOCKS, WOOL AND WOOL-COTTON MIXTURE, require a merino yarn composed of wool, not lower in grade than 64s (U. S. Standard), and cotton. The blend is so proportioned that the finished socks, exclusive of the heel and toe, will analyze not less than 50 per cent wool. The cotton and wool are separately carded and combed before blending. The yarn is a single and may be spun on either the worsted or cotton system. The color for type I socks is obtained by mixing 3 to 5 per cent natural black or fast black wool with the white wool and cotton. The socks are seamless, circular knit. The leg, heel, toe, and ribbed cuff are knit from two ends of yarn. The leg, heel, and toe are made with a plain stitch. The ribbed cuff is made with a 1 x 1 rib stitch, finished with a well-defined welt, and transferred or joined to the leg, loop

for loop, without seaming or sewing in such a manner as to permit expansion to the full width of the fabric. The finished cuff measures 5½ inches long, with a tolerance of plus or minus ¼-inch allowed. The socks are provided with a full size heel and toe made by using one-half of the total number of needles. The gore of the heel and toe must be knit with not less than 24 needles on each side. The toes have a ½-inch advanced or ring splicing. The seam across the toe must be elastic, smooth, and free from lumps or laps. If a looping machine is used it should have a two-needle looper (a needle and a hook) using a thread of yarn in each needle. The socks shall be knit full, so that they will finish to the proper size and length without stretching during boarding. The length of leg from the extreme ribbed top to the lower edge of heel must measure 14 inches for sizes 10 and under, 14½ inches for sizes 10½ to 13, and 15½ inches for sizes 13½ and up. A tolerance of plus or minus ½-inch is allowed. The length of the foot in inches is denoted by size and each sock has the proper size stamped on the toe. A plus tolerance of ½-inch will be permitted in the foot length. The socks are knitted with a loose elastic stitch so that the finished socks shall have good elasticity, and capable of being stretched with a slight amount of tension to widths, measured across the foot at a point midway between the toe and heel, or not less than 6 inches for sizes 10½ and under, and not less than 6½ inches for sizes over 10½. The socks must be thoroughly scoured to remove oils and grease and then boarded on drying forms to the proper shape and size. Type II socks must be dyed black with a diazotized and developed direct dye and have good fastness to light, laundering, crocking, and perspiration.

UNDERSHIRTS, MEN'S, COTTON, FLAT-KNIT, LIGHT-WEIGHT, are of the pull-over type with short sleeves and are made from single yarn of combed peeler cotton. The fabric is flat knit, using a plain stitch, with 30 wales per inch and 32 courses per inch finished. The fabric is fully bleached and shrunk before cutting into garments. The body of the garment is circular without side seams with a one inch hem at bottom. The collarette is ¾-inch wide, circular and of double thickness, using the same yarns as the body but knitted on a collarette machine. Two pair of eyelets or button-holes well worked with 3 cord cotton thread and reinforced with tape are placed one pair on each side in the hem of the shirt. The sleeves are seamed on the underside and are finished with a one inch hem at bottom. The undershirts are made in nine sizes as tabulated below. (Requirements for seams and stitches are shown in table at bottom of page.)

Weight Per Dozen
(Plus or minus 6 per cent tolerance)

Size	30	32	34	36	38	40	42	44	46
Weight lbs.	2	2¼	2½	2¾	3	3¼	3½	3¾	4

Measurements

	30	32	34	36	38	40	42	44	46	*Tolerance*
Width of Garment (Inches)	15	16	17	18	19	20	21	22	23	6%
Total length (Ins.)	31	31	32	33	33	34	34	35	35	1 In.
Armhole length (In.)	8	8	8	8	8	8	9	9	9	1 In.
Neck opening (In.)	19	19	19	19	20	20	20	21	21	1 In.
Sleeve length (In.)	6	6	6	6	6	6	6	6	6	½ In.

UNDERSHIRTS; MEN'S, COTTON-WOOL, MIXED, are of the pull-over type with high neck and long sleeves made from two yarns, one worsted spun merino and one combed cotton. The merino yarn is spun from wool not lower in grade than 60s (U. S. Standard) and cotton of grade not lower than Middling (U. S. Standard). The fabric is made with a 1 x 1 rib stitch in such a manner

Requirements for Seams and Stitches

Operation	*Seam Type*	*Stitch Types 1st Step*	*Step 2nd*	*Needle Thread*	*Lower Thread*	*Thread Upper*	*Max. Needle Diam.*	*Stitches Per Inch*
Seaming and attaching sleeves (flat seam)	FSa-1	604	...	3-70	36/2	30/2	.032	14
		606	...	3-70	36/2	36/2	.032	14
		606	...	3-70	60/2	36/2	.032	16
Seaming and attaching sleeves (seam and cover seam)	SSh-2	401	...	none given for 401			...	..
		503	...	3-70	3-70	...	.032	13
		...	406	3-70	36/2	...	.036	13
Attaching collarette (flat seam)	FSa-1	604	...	3-70	30/2	30/2	.036	14
		605	...	3-70	30/2	30/2	.036	14
		606	...	3-70	60/2	30/2	.036	16
Attaching collarette (binding seam)	BSf-2	401	...	none given for 401			...	..
		503	...	3-70	3-70	...	.032	10
		...	604	3-70	30/2	30/2	.036	14
		...	605	3-70	30/2	30/2	.036	14
		...	606	3-70	60/2	30/2	.036	16
Attaching collarette (seam and cover seam)	SSh-2	401	...	none given for 401			...	..
		503	...	3-70	3-70	...	.032	13
		...	603	3-70	36/2	36/2	.036	12
Hemming bottom and ends of sleeves	EFc-1	503	...	3-70	3-70	...	.032	12
Attaching eyelet or buttonhole reinforcement to shirt	LSd-1 and LSa-1	301	...	3-70	3-90	...	.036	10
		401	...	3-70	3-90	...	.036	10
Making buttonholes	....	304	...	3-70	3-70	...	.032	..
		503	...	3-70	3-70	...	.032	..

NOTE: Threads are given with ply preceding number, e.g., 3-70. Mercerized yarns are given with ply succeeding number, e.g., 30/2.

that the worsted merino yarn is plaited over the cotton yarn. The knitted fabric must contain 36 per cent wool, and be thoroughly scoured and shrunk so that the garment in laundering will not shrink more than 6 per cent in either direction of the wales or courses nor exceed a total of 7 per cent in both directions. The finished fabric contains a minimum of 22 wales and 30 courses per inch and has a breaking strength of 45 pounds in the direction of the wales. The body of the garment is circular without side seams with a one inch hem at the bottom. The collarette is ¾-inch wide, circular and of double thickness made of the same yarns as used in the body of the garment, and knitted on a collarette machine. Two pair of eyelets or buttonholes well worked with 3-cord cotton thread and reinforced with tape are placed, one pair on each side in the hem of the shirt. The sleeves are finished with ribbed cuffs (either single or double) knit with a 1 x 1 rib stitch. The cuffs are 4 to 5 inches in length and are 2½ to 3½ inches in width. If single, the cuffs should have a knitted welt at the outer end. The seams joining the cuff to the sleeve and the cuff fabric should stretch at least 50 per cent of the original width without breaking, and return to approximately its original width. Undershirts are made in 8 sizes, 32 to 46. (See tables at bottom of this page.)

DRAWERS: MEN'S, COTTON-WOOL, MIXED, are of the ankle length type, made from two yarns, one worsted spun merino and one combed cotton. The merino yarn is spun from wool not lower in grade than 60s (U. S. Standard) and cotton of grade not lower than Middling (U. S. Standard). The fabric is made with a 1 x 1 rib stitch in such a manner that the worsted merino yarn is plaited over the cotton yarn. The knitted fabric must contain 36 per cent wool, and be thoroughly scoured and shrunk so that the garment in laundering will not shrink more than 6 per cent in either direction of the wales or courses nor exceed a total of 7 per cent in both directions. The

Weight Per Dozen in Pounds

Size	32	34	36	38	40	42	44	46
Weight	5¾	6	6¼	6⅝	7¼	7⅝	8¼	8½

Measurements

	32 *Inches*	34 *Inches*	36 *Inches*	38 *Inches*	40 *Inches*	42 *Inches*	44 *Inches*	46 *Inches*	*Tolerance*
Width { 8, 9, 10 cut	12¾	13½	14¼	15	15¾	16½	17¼	18	6 per cent
Width { 11, 12, 14 cut	12¼	13	13¾	14½	15¼	15¾	16½	17¼	6 per cent
Length	31	31	31	32	33	34	34	34	1 inch
Sleeve length	21	21	21	21	22	22	22	22	1 inch
Armhole length	8	8	8	8	9	9	9	9	1 inch
Collarette length	18	18	18	19	19	19	20	20	

Requirements for Seams and Stitches

	Seam Type	*Stitch Type*	*Needle Thread*	*Lower Thread*	*Upper Thread*	*Stitches Per Inch*
Seaming and stitching sleeves, flat seam	FSa-1	603	3-50	24/2	24/2	12
		604	3-50	24/2	24/2	12
		605	3-50	24/2	24/2	12
		606	3-70	40/2	24/2	14
Attaching cuffs	FSa-1	603	3-50	24/2	24/2	14
		604	3-50	24/2	24/2	16
		605	3-50	24/2	24/2	16
		606	3-70	40/2	24/2	14
Inserting shoulder strips	FSa-1	603	3-50	24/2	24/2	12
		604	3-50	24/2	24/2	12
		605	3-50	24/2	24/2	12
		606	3-70	40/2	24/2	12
Attaching collarette, flat seam	FSa-1	603	3-50	24/2	24/2	12
		604	3-50	24/2	24/2	12
		605	3-50	24/2	24/2	12
		606	3-70	40/2	24/2	14
Attaching collarette, flat seam	BSf-2	401	3-50	3-50	....	10
	BSa-1	503	3-50	3-50	....	10
		406	3-50	24/2	24/2	12
		605	3-50	24/2	24/2	12
Hemming bottom		503	3-70	24/2	....	12
	EFc-1	502	3-70	24/2	....	12
	EFa-1	503	3-70	24/2	....	12
		504	3-70	3-70	24/2	12
		505	3-70	3-70	24/2	12
Attaching eyelet (or buttonhole) reinforcement to shirt	LSd-1	301	3-50	3-50	....	10
	LSa-1	401	3-50	3-50	....	10
Making buttonholes	Buttonhole stitch		....	....	....	40

NOTE: Threads are given with ply preceding number, e.g., 3-70; mercerized yarns are given with ply succeeding number, e.g., 30/2.

finished fabric contains a minimum of 22 wales and 30 courses per inch and has a breaking strength of 45 pounds in the direction of the wales. The drawers have a "French type" sateen waistband 2¼ inches wide at the back extended down each side of the front opening not less than 7 inches. The front opening is lined with a ¾ inch tape and has three buttons, 2½ inches apart with corresponding buttonholes. The back has a "U" placket with three eyelets or buttonholes on each side, lined with tape, and is held together with a suitable lacing. There are two pairs of eyelets worked in the waistband, one pair on each side of the garment. The crotch has a wing type gusset the center portion of which is made of double thickness of body fabric, approximately 6 inches wide and 10½ inches long. The wings of the gusset are of single thickness approximately 3½ inches wide and 6½ inches long. The legs are finished with anklets 5 to 6 inches long and 3½ to 4½ inches wide. The anklets may be either single with a knitted welt at the outer end or of double thickness. The anklets are made with a 1 x 1 rib stitch using the same size yarn as the body fabric with a minimum of 17 wales per inch and 30 courses per inch when finished. The seam joining the anklet to the leg and the anklet fabric shall stretch at least 50 per cent without breaking, and return to approximately its original width. Drawers are made in 8 sizes, 30 to 44. (See tables below.)

Specification Requirements

Item	*Undershirts, Cotton*	*Undershirts, Cotton-Wool Mixed*	*Drawers, Cotton-Wool Mixed*
		Type II	
		Class D, Subtype 15	
Federal Specification No.	JJ-U-513	JJ-U-517	JJ-D-653
Material:		Blend	
Stock	Cotton (Peeler)	36 per cent wool and 64 per cent cotton	
Grade No.		Wool—60s U. S. Standard Cotton—middling	
Yarns	single, combed	Two yarns: 1 worsted spun merino and 1 combed cotton	
Machine	Circular	Circular	Circular or Flat
Fabric:			
Body stitch	Flat knit	1 x 1 rib	
Wales per inch—Body fabric	30	22	
Cuffs	..	17	
Courses per inch	32	30	
Size	Tabulated		
Weight	Dependent on size		
Color	Bleached	Scoured (Unbleached)	

Alternate Requirements

Yarns	Double carded or slow carded

Weight Per Dozen in Pounds

Size	30	32	34	36	38	40	42	44
Weight	4¾	4⅞	5⅜	5⅞	6¼	6½	6⅞	7¼

Measurements

Size	30	32	34	36	38	40	42	44	*Tolerance*
Length	39	39¾	40½	41¼	42	42¾	43½	44	1 inch
Waist	30	32	34	36	38	40	42	44	1 inch
Front rise	13¾	14	14¼	14½	14¾	15	15¼	15½	¾ inch
Back rise	15½	15¾	16	16¼	16½	16¾	17	17¼	¾ inch
Width of seat	14	14½	15½	16½	17½	18½	19¼	20	1 inch
Width of thigh	7¾	8	8½	9	9½	10	10¼	10¾	6 per cent
Width of calf	5	5¼	5⅜	5½	5¾	5⅞	6	6⅛	6 per cent
Length front opening	10	10¼	10½	10¾	11	11¼	11½	11¾	½ inch

Requirements for Seams and Stitches

Operation	*Seam Type*	*Stitch Type*	*Needle Thread*	*Lower Thread*	*Upper Thread*	*Stitches Per Inch*
Seaming legs and gussets (flat seam)	FSa-1	603	3–50	24/2	24/2	12
		604	3–50	24/2	24/2	12
		605	3–50	24/2	24/2	12
		606	3–70	40/2	24/2	14
Attaching cuffs	FSa-1	603	3–50	24/2	24/2	12
		604	3–50	24/2	24/2	16
		605	3–50	24/2	24/2	16
		606	3–70	40/2	24/2	14
Attaching top of waistband	SSc-1	301	3–50	3–50	....	12
	SSc-2	401	3–50	3–70	....	12
Stitching lower edge of waistband	LSd-2	301	3–50	3–50	....	12
		401	3–50	3–70	....	12
Attaching front and back edge of waistband	SSb-1	301	3–50	3–50	....	12
		401	3–50	3–70	....	12
Taping front and back plackets	SSb-2	301	3–50	3–50	....	10
		401	3–50	3–70	....	10
Making buttonholes	Buttonhole straight	...	3–50	3–50	....	52
Attaching buttons	....	101	....	....	....	16
		301	....	....	....	16

NOTE: Threads are given with ply preceding number, e.g., 370. Mercerized yarns are given with ply succeeding number, e.g., 30/2. A ⅝ inch buttonhole to be made with not less than 100 stitches, bar stitches included.

Specification Requirements

Item Navy Department Specification No.	*Caps, Watch* 73C3a	*Gloves, Woolen* 73G2a	*Jerseys* 55J2h	*Trunks, Bathing* 37T2a
Material:				
Stock	Fleece or Pulled Wool		Fleece Wool	
Quality No.	U. S. Standard 56s			60s
Yarn	2 or 3-ply worsted	woolen	2-ply worsted	
Dyed	stock or yarn	stock	skein	stock or yarn
Color	Dark Navy blue to match standard sample			
Color fastness	Equal to fastness of standard sample			
Machine	Circular or flat	Full-fashioned	Circular	Circular or flat
Fabric:				
Body stitch	Full cardigan	Plain	Plain	1x1 rib
Wales per inch	6-7			22
Courses per inch	12-13		10-11	35
Cuff stitch		1x1 or 2x2 rib	1x1 rib	
Collar stitch			1x1 rib	
Border stitch			2x2 rib	
Size		Tabulated		
Weight	3½-4 oz. each	Dependent upon size		10.5 oz./sq. yd.

Alternate Requirements

Quality No.	50s	52s	
Yarn			singles, worsted
Machine		Flat	

Specification Requirements

Item	*Socks, Cotton, Class B, Black, Combed Mercerized*	*Socks, wool-cotton mixture Class A*	
		Type I	*Type II*
Federal Specification number	JJ-S-566a and Amendments	JJ-S-581a	
Material:			
Stock	Cotton	Blend 50 per cent wool and 50 per cent cotton	
Grade No.	Middling	Wool—64s U. S. Standard Cotton—suitable	
Diameter of machine (inches)	3½ up to size 10½; 3½ or 3¾ size 11 up	3½ to 3¾	
Needles per machine (minimum)	200	176	
Courses per inch (minimum)	30, or a minimum of 6,000 loops per inch of fabric	25	
Needles for gore of heel and toe (min.) (each side)	28	24	
Yarns	Tolerance for size, plus or minus 5 per cent		
	1 end 40/2 and 1 end 50/2; 2 ends of 40/2;		
Heel and Toe	2 ends of 45/2; or 2 ends of 50/2	2 ends 1/30	
Leg and Foot	1 end of 40/2	2 ends 1/30	
Looping yarn	Suitable	3-ply, cotton, mercerized	
Reinforcing:			
Heel and Toe	Suitable	1 end 1/30, cotton	
Sole and high splicing	1 end of 60/1		
Rib	1 end of 36/2	2 ends 1/30	
Heel	High spliced 60/1		
Sole	Reinforced 1 end of 60/1		
Sizes	9½-10-10½-11-11½-12	10½-11-11½-12-12½ and 13	
Weight per dozen pair	14½-15-15¾-16-16½-16¾ ozs.	24-24½-25-25½-26 and 26½ ozs.	
Dye	Diazotized and developed direct dye		Diazotized and developed direct dye
Color	Black	Silver-gray blend obtained by mixing 3 to 5 per cent natural black or fast dyed black wool with white wool and cotton	Black
Color fastness	Equal to fastness of standard sample		

The cotton sewing thread used in the manufacture of these garments must conform to the requirements of Federal Specification No. V-T-276b, Thread; Cotton. The seams and stitch types specified are those covered by Federal Specification No. DDD-S-751, Stitches; Seams; and Stitching. All physical and chemical tests are conducted in accordance with the methods prescribed in Federal Specification No. CCC-T-191a, Textiles; General Specifications; Test Methods.

Prospective bidders and contractors should provide themselves with the necessary copies of specifications of the issue in effect on date of invitation for bids. Copies of specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. When requesting copies of specifications the applicant should refer to the specification by both title and number.

In all respects not specifically covered by the governing specifications the manufactured article must be equal to the standard sample. Firms interested in bidding on a schedule may obtain a standard sample upon application to, and depositing the amount stated in the schedule with the Officer-in-Charge, Naval Clothing Depot, Brooklyn, New York. The deposit is forfeited if the sample is not returned in good condition within thirty days after the date of opening the bids.

BOOK REVIEWS

Cotton Loomfixers' Manual *by Ivar Moberg, Instructor in Weaving, Loomfixing, and Designing, Nashua Manufacturing Co., Instructor at Lowell Textile Institute. First Edition. McGraw-Hill Book Co., Inc., New York. 200 pages, 108 illustrations. Price* $2.50.

This book fills a long felt need in the field of loomfixing, as there has been a dearth of technical literature upon this subject. It will serve as a textbook for instructors upon this subject and as a reference book for loomfixers, and those who may wish to improve their knowledge and skill upon this subject. The book is excellently and profusely illustrated, a point of considerable value in a book of this type.

"Standardization Activities of National Technical and Trade Organizations." *A bound volume of 288 pages, compiled by the National Bureau of Standards, can be purchased from the Supt. of Documents, Government Printing Office, Washington, D. C., for 75 cents.*

It covers general standardizing agencies, standardization activities of technical societies and trade associations, services of the National Bureau of Standards and Procurement Division, and a bibliography on standardization. A 22 page index lists alphabetically both the organizations and the various products with which they deal.

The Condensed Chemical Dictionary. *3rd Edition. Reinhold Publishing Co., 330 West 42nd Street, New York, N. Y. 756 pages. Price* $12.00.

This new edition of the Condensed Chemical Dictionary has been greatly improved over the second edition with over 6,000 new items added. In addition, the 12,000 older items have been brought up to date by general and partial revision.

This third edition has been made necessary largely because of the greatly increased number of so-called chemical specialties which are sold only under trade or brand names. Such articles have been specifically described because many of these names in the past have often been taken for actual chemical names. All descriptions of such products have been strictly limited to facts.

This book includes data on chemical and physical properties of chemicals and raw materials. These data have been taken from three sources: (a) the technical literature; (b) private files of many of the leading chemical manufacturers; (c) latest catalogs of leading chemical manufacturers and their descriptions of various chemicals available. The editor states that as far as he knows it is the only dictionary carrying this type of information. Several hundred individual contributors have furnished material for this third edition.

The Textile Recorder Year Book, 1941. *Published by the Textile Recorder (Harlequin Press), Old Colony House, South King Street, Manchester, England. Price 10 s 6 d. 818 pages.*

This issue of the Textile Recorder Year Book is the second to be produced during the war, and the publishers should be complimented for the production of such a creditable volume under the pressure of circumstances. For obvious reasons changes have kept to a minimum, but all necessary adjustments have been made, and this issue compares favorably with all previous issues and comes up to the excellent standard which has been maintained by this publication since its first introduction. It is well described by its publishers as "A Textile Library in Brief." While English practice described in this book, is in some instances different from that followed in America, this is of value because it will give its readers a broader view of the industry.

As in previous years the book is divided into the following sections:

Section A—Cotton.
Section B—Woolen and Worsted.
Section C—Rayon.
Section D—Silk.
Section E—Flax and Linen.
Section F—Jute.
Section G—Hosiery and Knitting.
Section H—Microscopy, Textile Testing.
Section I—Power Transmission.
Section J—Miscellaneous.

The book contains something helpful and of interest to all the fundamental branches of the textile industry.

Simplified System of Organic Identification. 48 *pages. By J. L. B. Smith, M.Sc., Ph.D., F.R.S.S.A. Published by The Chemical Publishing Co., Inc., 234 King Street, Brooklyn, N. Y. Price* $1.50. 1942.

This small laboratory manual is an essentially practical work, based upon methods which have proved themselves in the hands of students over many years. The procedure in this system is a departure from the usual method of attack, and by its aid complicating factors are initially eliminated, leaving systematic clear-cut class determinations. The main feature of the work is the presentation of the chief differentiations in the form of tables, which students find easy to follow, so that they rapidly become proficient in this branch of practical chemistry.

In this manual manipulation and apparatus are reduced to the simplest terms, largely by modification of standard procedure. There may be mentioned the method described for sodium fusions, whereby that reaction is rendered safe, certain, almost fool-proof, with even volatile compounds, while employing relatively minute amounts of reactants.

The system is primarily for Degree students, and while of wider range than usually required for medical students, it may by simple elimination readily be adapted to their needs, and provides easy and sharp differentiations.

All the common types of organic compounds (excepting alkaloids and dyestuffs) are included. In all about 250 individual compounds, besides salts of organic acids. A special table contains methods for the rapid identification of the metallic portion of salts, and the composition and strength of all reagent solutions are given.

This Chemical Age. *By Williams Haynes. 407 pages. 16 full page colored illustrations, two wood cuts and two charts. Published by Alfred A. Knopf. New York.* 1942. *Price* $3.50.

Mr. Haynes who has had a long experience as a writer, particularly along chemical lines, has won a reputation as one of America's foremost chemical economists. Furthermore he has a way of writing which is not too advanced for laymen who have a smattering of chemistry, and at the same time not so completely popularized as to lack interest and value to the trained chemist.

The chapters entitled "Black Tar to Bright Dyes," "The Rise and Fall of the German Dye Trust," and "New Fibers and Fabrics" will be of special interest to readers of the DYESTUFF REPORTER.

The story of Sir William Perkins' discovery of Mauve and its manufacture on a commercial scale, the development of the dye industry in Germany and its more recent development in the United States is told in a fascinating way. The chapter on the "Sulfanilamid Family" of drugs which have so miraculously revolutionized both medicine and surgery in the last two or three years should prove of personal interest to everyone. The three chapters devoted to Rubber both natural and synthetic are of special interest at the present time, also the chapter on explosives entitled "Mars: Chemical Dictator."

The whole book is a series of fascinating stories of research, discovery, invention and industrial development, and will certainly prove a valuable volume to all interested in the whys and wherefores of the things that represent modern living.

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The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $6.25 per column inch or less per insertion.

POSITION WANTED: Hosiery dyer for past sixteen years on pure silk, cotton, rayon, nylon and mixed fibers, with large hosiery mill in south as head dyer. Capable of handling large production, willing to go anywhere, best reference. Member of American Association of Textile Chemists and Colorists. Write Box No. 355, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Research chemist for work on chemical specialties used in textile and allied trades. Practical textile experience desirable. Give experience, education and references. Write Box No. 366, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Research chemist. Twelve years' active experience. Includes nine years dyeing and finishing plant control laboratory director. Broad experience on research, development, chemical processing, supervisory and trouble diagnosis. Desires position with chemical manufacturer for research and textile service. Married. Employed. Southern New England or New York area preferred. Write Box No. 377, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

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WANTED: Textile Chemist for sales work. Knowledge of printing, dyeing and finishing. State age, experience, draft status and salary expected. Enclose recent photo. Write Box No. 379, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

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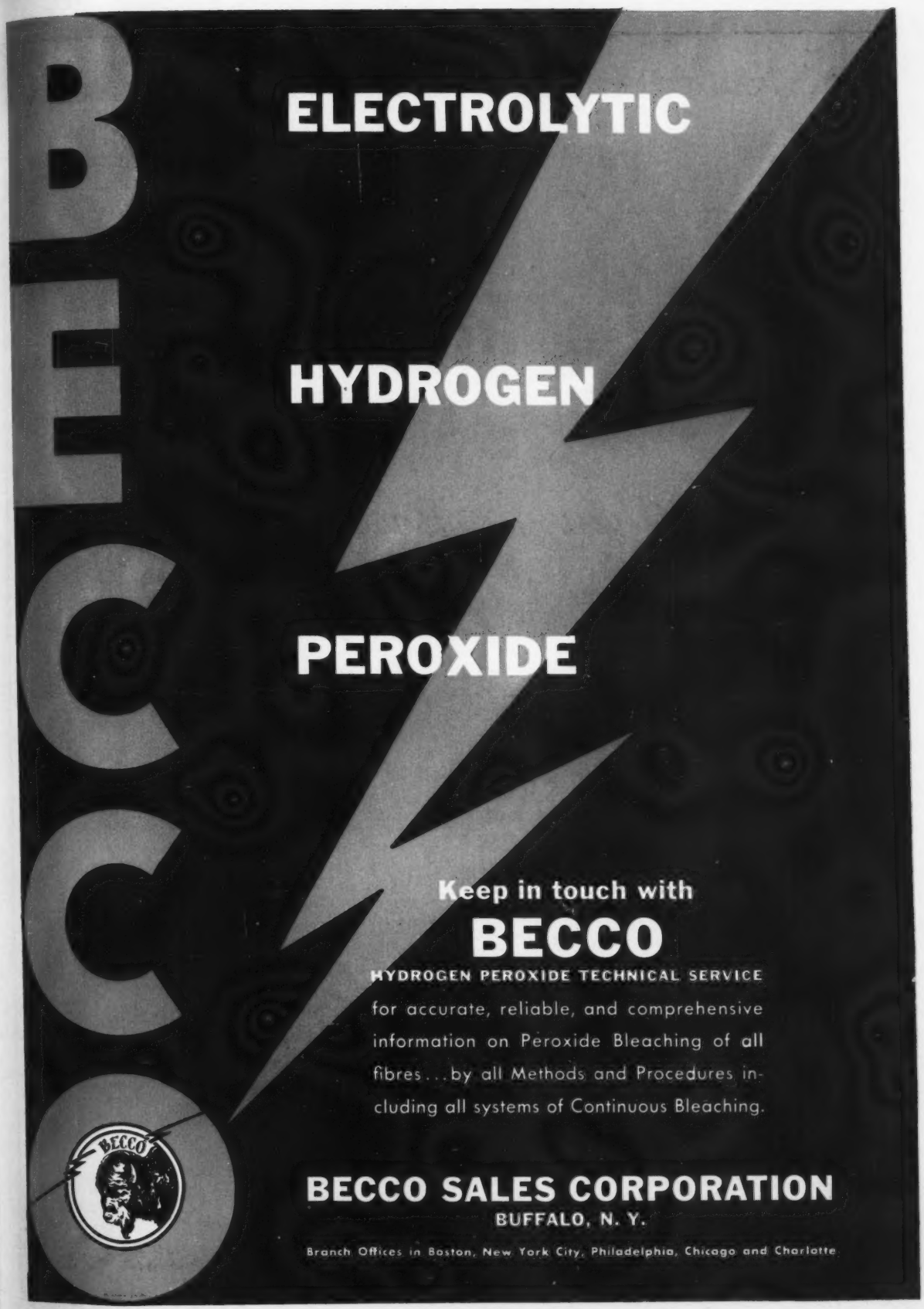
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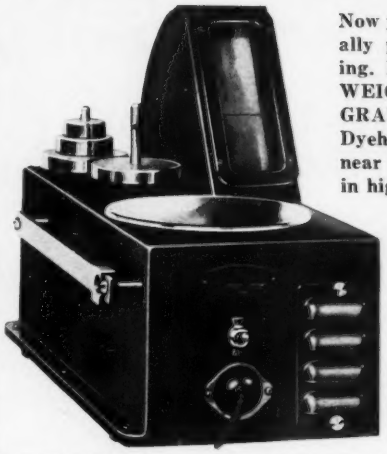

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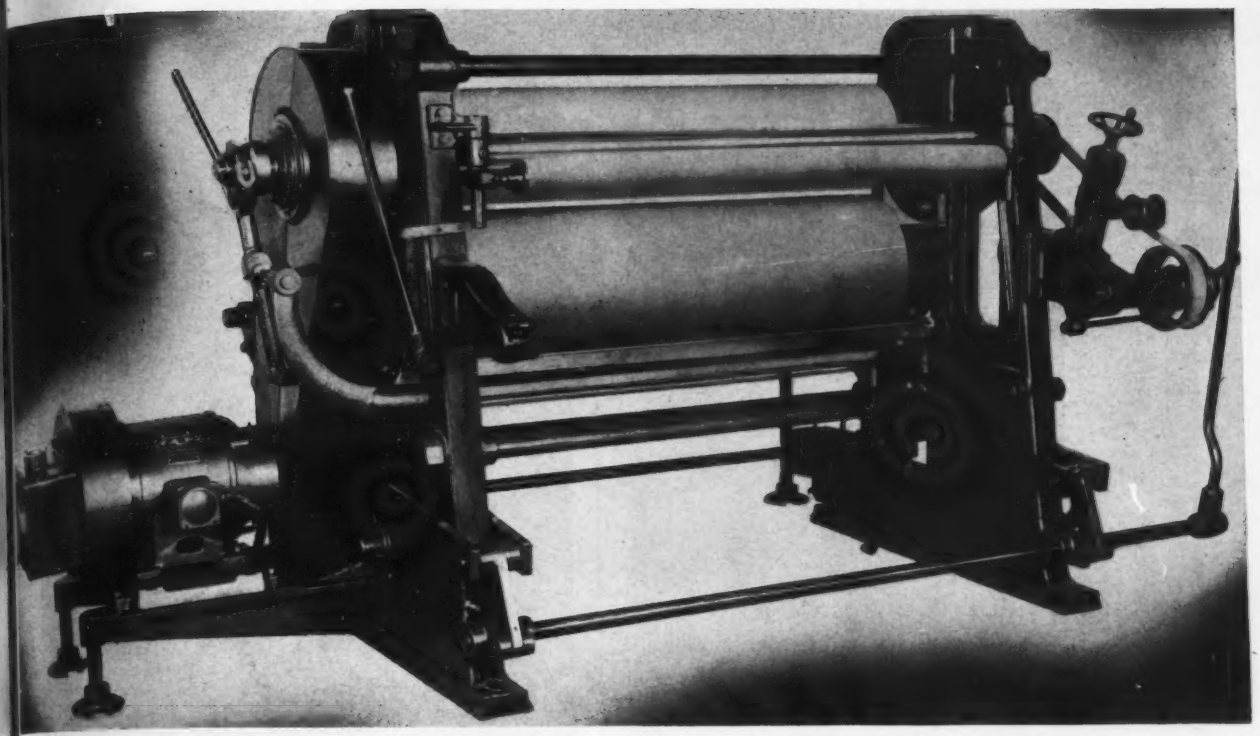

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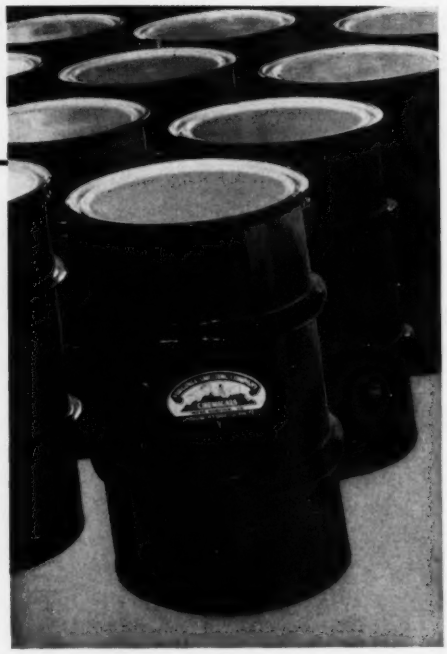

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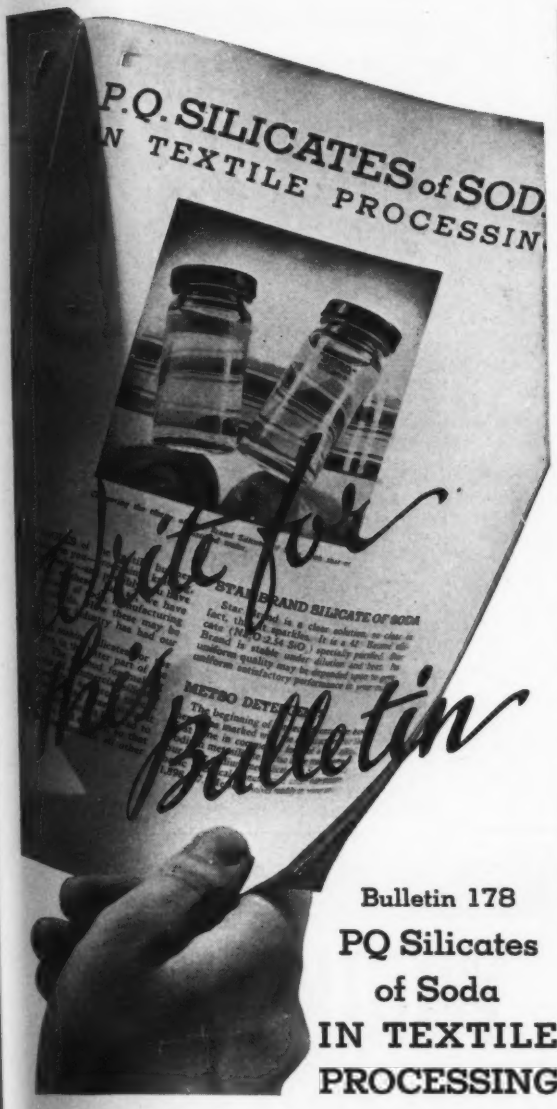

Bulletin 178

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The Annual
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will appear
OCTOBER 12, 1942

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Further details will be announced at a later date.

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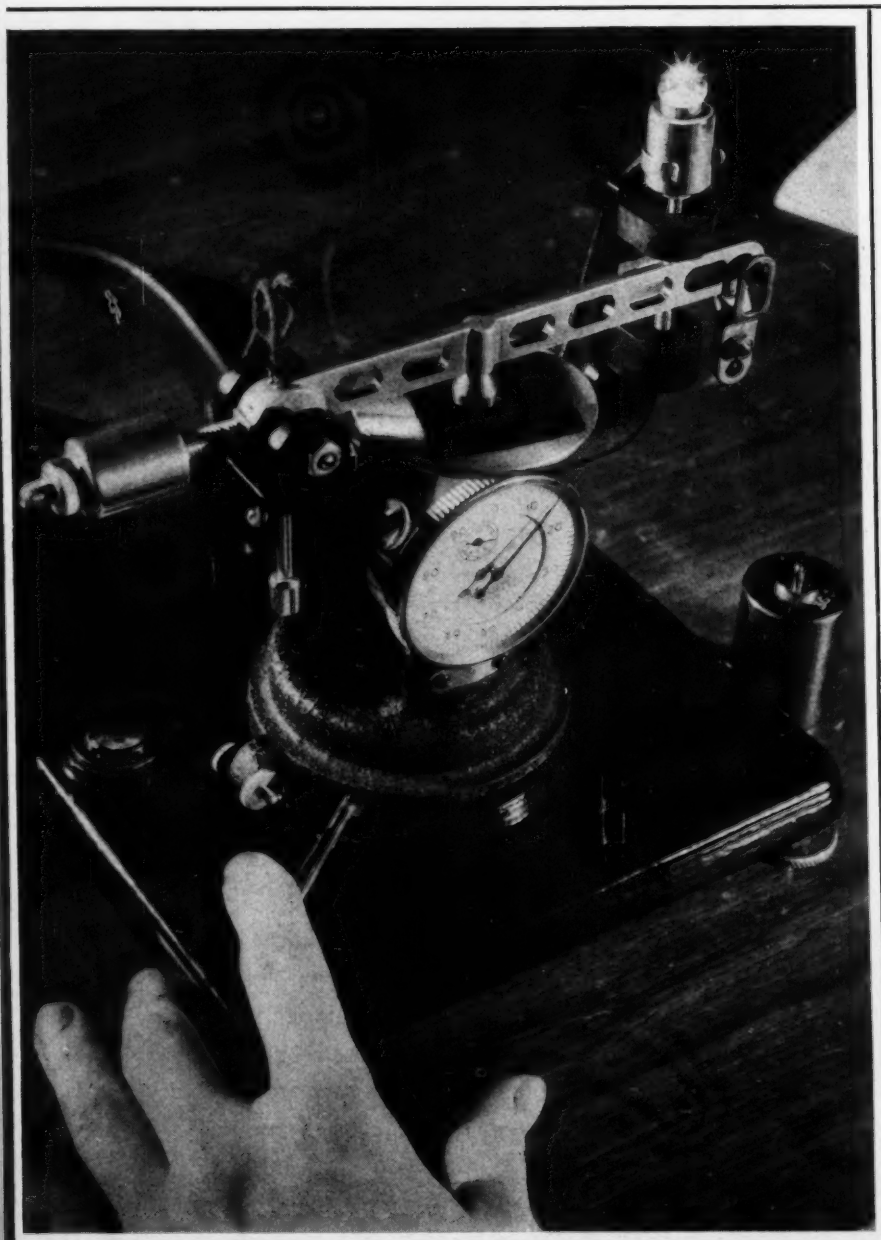

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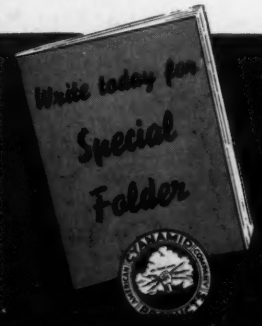
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